THE
ARITHMETICIAN'S ASSISTANT,

BEING

A COMPLETE SYSTEM

OF

PRACTICAL ARITHMETIC,

DESIGNED

AS A TEXT-BOOK,

FOR THE USE OF SCHOOLS, MEN OF BUSINESS, &c.

BY R. WISEMAN,

TEACHER OF ARITHMETIC, ETC. CUPAR IN FIFE.

ENTERED AT STATIONERS' HALL.

DEDICATION.

SIR,

PERMIT me to prefent you with the following work, calculated to render the ftudy of ARITHMETIC more methodical, eafy, and entertaining to the learner;—not as a compliment, but as a mark of that profound veneration and refpect which I have always entertained to the memory of your worthy father, and of that attachment and gratitude with which I have the honour to be,

SIR,

Your moft obedient,

much obliged,

and very humble fervant,

R. WISEMAN.

PREFACE.

IN a mercantile country, such as Great Britain, where the exiftence of many thoufands depends on trade, both fkill and addrefs are requifite in the induftrious merchant, to enable him to carry into effect his fchemes of commerce.

Youth, deftined for the mercantile profeffion, ought to be early initiated, and well founded, in the principles of *arithmetic*; for it is by a thorough knowledge of this fcience alone that a juft calculation is made, by which the merchant can judge with certainty when, and where, to embrace his opportunity of profit.

Books on *arithmetic* concifely written and methodically arranged, are a treafure to the young accountant: neither can too many attempts be made to improve and render them complete; and here I fhall offer no other apology for the prefent publication.

In this new fyftem of *practical arithmetic*, great care has been taken to exprefs every thing in fimple language, fo as to be the more generally ufeful. Brevity and perfpicuity are attended to throughout the whole, and prolixity and obfcurity every where avoided; fo that it is prefumed, more ufeful matter will be found in this

performance, than in many others of twice its size and double its price.

In the *decimal* department, the most approved methods of working finites, repetends, and circulates, are introduced and illustrated in the clearest manner, as far as they are useful, with their various applications to the business of the banker, the merchant, and the mechanic.

In a word, it is hoped that the whole will be found so digested and arranged as to form a complete system of *arithmetic*, thereby fully answering the purpose of a TEXT-BOOK, in the science it treats of, and to be of great use both to the tutor and pupil.

R. W.

N. B. A letter, post paid, addressed to the Author, will procure the solution at large, of any QUESTION *in the following work.*

CONTENTS.

CONTENTS.

ARITHMETIC.

A RITHMETIC is the art of numbering, or of computing by numbers. The whole of this science depends on five fundamental rules, viz. Notation, Addition, Subtraction, Multiplication, and Division; and by the proper application and judicious management of these, the most complicated processes, curious calculations, and surprising solutions, may be effected.

NOTATION.

NOTATION teaches the method of writing down, and expressing in figures, any number that can be conceived or proposed.

The characters by which any number may be expressed are these ten, viz. 1, one; 2, two; 3, three; 4, four; 5, five; 6, six; 7, seven; 8, eight; 9, nine; 0, cypher; whose several local values may be easily learned from the following table.

Ten Thousands of Billions.	Thousands of Billions.	Hundreds of Billions.	Tens of Billions.	Billions.	Hundred Thousands of Millions.	Ten Thousands of Millions.	Thousands of Millions.	Hundreds of Millions.	Tens of Millions.	Millions.	Hundreds of Thousands.	Tens of Thousands.	Thousands.	Hundreds.	Tens.	Units.
9	3	4	8	4	9	8	7	6	5	4	3	2	1	3	9	4

Note. The operation of reckoning or reading the value of any number expressed in figures, is called Numeration.

A

PROB. I.—To write down any number in figures.

RULE.—Put the significant figures in the places proposed; and fill up the vacancies with cyphers.

Ex. 1.—Write down in figures, six hundred and forty-four millions.   Anf. 644000000.

2. Write down seven hundred and fifty-nine million, three hundred and twenty-four thousand, three hundred and thirty-six.

PROB. II.—To read any series of figures.

RULE.—Begin at the left hand, and reckon towards the right; to the simple value of each figure affix its local value; conclude each period by expressing its title, and omit the cyphers every where.

Ex. 1.—Read 7734039. Anf. Seven millions, seven hundred and thirty-four thousand, and thirty-nine.

2. Read 800734734.

3. —— 9100007133.

CHARACTERS EXPLAINED.

$+$ Plus, more; the sign of Addition.

$-$ Minus, lefs; the sign of Subtraction.

$\times$ Multiplied by; the sign of Multiplication.

$\div$ Divided by; the sign of Division.

$=$ Equal to; the sign of Equality.

$::$ So is; the sign of Proportion; as $3 : 6 :: 8 : 16$.

$\sqrt{}$ Square root.

$\sqrt[3]{}$ Cube root.

ADDITION OF INTEGERS.

RULE.—Arrange the given numbers fo, that units, tens, hundreds, &c. may form fo many columns refpectively: Then beginning at the column of units, find

its fum; and for each 10 that fum contains, carry 1 to the next fuperior place, and write the excefs (if any) exactly under the column added: Proceed in like manner with every fucceeding column to the laft; under which write down the whole fum.

EXAMPLES.

(1.)		(2.)		(3.)	
48	3	4172	5	9443347	7
54	0	1473	6	948473	8
45	0	2541	3	94741	7
72	0	7374	3	9734	5
17	8	1294	7	949	4
84	3	7174	1	94	4
79	7	3426	6	9	0
399	3	27454	4	10497347	8

Note. The judicious teacher is here underftood to fubjoin examples fimilar to the above to his pupils at pleafure, till they acquire a tolerable eafe and accuracy in adding.

Proof. By ejecting the 9s, as in the preceding examples.

PRACTICAL QUESTIONS.

1. G borrowed of H at one time L 9; at another L 27; at a third L 940; at a fourth L 7409; and at a fifth L 88441; What fum was borrowed in all?

<div align="right">Anf. L 96826.</div>

2. A farmer has 14 horfes, 19 cows, 36 yearlings, 25 calves, 300 fheep, 11 goats, and 18 hogs; Required the number of his live ftock? Anf. 423.

3. A gentleman has in his library 18 vols. folio, 84 do. quarto, 149 do. octavo, and 231 do. duodecimo; How many has he in all? Anf. 482.

4. Lent A L 7480; B L 947; C L 91; D L 8; E L 117; and F L 4731; What fum was lent in all?

<div align="right">Anf. L 13374.</div>

5. The account of a certain fchool was as under,

A 2

viz. in the Primer 13; Spelling-book 16; Æsop's Fables 11; Bible 25; Collection 22; at Arithmetic 17; Book-keeping 3; and at Navigation 1; How many were there in all? Anf. 108.

6. Borrowed of A sixty-three pounds; of B twenty-nine pounds; of C three hundred and forty-eight pounds; and of D one thousand and four pounds; What sum did I borrow in all? Anf. L 1444.

7. The produce of a corn farm was as under, viz. wheat 156 bolls; barley 72; beans 108; peafe 119; and oats 390; How many bolls of grain did the farm produce? Anf. 845 bolls.

8. Suppofe a man to have been born in the year 1752; In what year will he be 65 years of age?
Anf. 1817.

9. Molly's fortune is L 840; Peggy's L 948; Eliza's L 582; and Janie is to have as much as all the three; Required her fortune? Anf. L 2370.

SUBTRACTION OF INTEGERS.

RULE.—Write the *fubtrahend* under the *minuend*, units under units, tens under tens, &c. Then beginning at the place of units, if the *fubtrahend* figure be lefs than the one correfponding to it in the *minuend*, write down the difference; if equal, write down a cypher; but if greater, increafe the *minuend* figure by 10, and then write down the difference; and for the faid 10 borrowed as above, 1 muft be added to the next *fubtrahend* figure; with which proceed as above directed to the end, and the remainder will fhew the difference of the two factors.

EXAMPLES.

(1.)		(2.)	
Minuend	7948436		973437428
Subtrahend	3428314		344542364
Difference	4520122		628895064
Proof	7948436		973437428

PRACTICAL QUESTIONS.

1. What is the difference between these two numbers, 807000314 and 97347018? Anf. 709653296.

2. Required the excefs of 707341 above 411114?
Anf. 296227.

3. How much does 888888 want of 1000000?
Anf. 111112.

4. Suppofe a church to have been built in the year 1617; How old is it in the year 1799? Anf. 182 years.

5. The abbey of Holyroodhoufe was founded in the year 1128; How old is it in the year 1799?
Anf. 671 years.

6. A gentleman who is now 87 years of age, was 39 years when his eldeft fon was born? Required the age of his fon? Anf. 48 years.

7. Borrowed L 700, and paid L 659; borrowed L 500, and paid L 511; borrowed L 400, and paid L 288; borrowed L 299, and paid L 333; Required the laft balance? Anf. L 108.

8. A was born in the year 1752, B 7 years fooner, and C is 5 years older than B; Required their feveral ages in 1799?
Anf. $\left\{\begin{array}{l} A\ 47 \\ B\ 54 \\ C\ 59 \end{array}\right\}$ years.

9. The diameter of the fun, according to the obfervations of aftronomers, is found to meafure 890000 miles; that of the earth only 7970; Required the difference? Anf. 882030 miles.

10. A gentleman whofe fortune is 3000 guineas, gives his eldeft fon B 909 guineas; his fecond C 808; and his third D 787; What fum does he retain to himfelf? Anf. 469 guineas.

11. A gentleman bought an eftate of 25800 acres; of which he has fold 7014 to A; 990 to B; 845 to C; and has let out in tack to fundry tenants 14424 acres; How many does he retain? Anf. 2527 acres.

A 3

N. B. The firſt ſtep in this rule is, to get the following table imprinted on the memory.

2		4		7		8
2—4	4—16	7—49
3—6	5—20	8—56
4—8	6—24	9—63
5—10	7—28	10—70
6—12	8—32	11—77
7—14	9—36	12—84
8—16	10—40	
9—18	11—44	8—64
10—20	12—48	9—72
11—22		10—80
12—24	5—25	11—88
	6—30	12—96
	7—35	
	8—40	9—81
	9—45	10—90
	10—50	11—99
3—9	11—55	12—108
4—12	12—60	
5—15		10—100
6—18	6—36	11—110
7—21	7—42	12—120
8—24	8—48	
9—27	9—54	11—121
10—30	10—60	12—132
11—33	11—66	
12—36	12—72	12 × 12—144

RULE I.—Place the *multiplier* under the *multiplicand,* units under units, tens under tens, &c. Then beginning at the place of units, multiply the whole *multiplicand* by each figure in the *multiplier* ſucceſſively, remembering to place the firſt figure of each *product* exactly under its reſpective *multiplier.* Laſtly, add the ſeveral products, and their ſum will be the anſwer.

Note. The number to be multiplied is called the *multiplicand;* that by which we multiply is called the *multiplier;* and the number arifing from the multiplication is called the *product.*

EXAMPLES.

(1.)   347254 multiplicand.   (2.) 8477563
            2 multiplier.   4
     694508 product.   33910252

3. Mul. 472864 by   5 = 2364320
4.   —— 743486 ×   6 = 4460916
5.   —— 372425 ×   7 = 2606975
6.   —— 454728 ×   8 = 3637824   ⎫
7.   —— 444333 ×   9 = 3998997   ⎬ Anf.
8.   —— 174342 × 10 = 1743420
9.   —— 243941 × 11 = 2683351
10. —— 347449 × 12 = 4169388   ⎭
11. —— 423256 × 37 =
12. —— 145689 × 75 =
13. —— 923414 × 447 =
14. —— 332211 × 8426 =

RULE II.——When either or both factors have cyphers on the right, multiply by the fignicant figures only, and annex the cyphers to the product.

EXAMPLES.

(1.)   7423000   (2.)   71200000
       2400   6400000
     29692   2848
    14846   4272
 17815200000   455680000000000

RULE III.——When the multiplier is a compofite number, and the component parts not exceeding 12, multiply continually by thefe component parts.

EXAMPLES.

1.	Mul. 74343 by 14	16.	Mul. 7438112 by	40
2.	— 84327 × 16	17.	— 8723428 ×	42
3.	— 94354 × 18	18.	— 1111111 ×	44
4.	— 147749 × 20	19.	— 3452468 ×	45
5.	— 343427 × 21	20.	— 1748184 ×	48
6.	— 841714 × 22	21.	— 3141471 ×	49
7.	— 147434 × 24	22.	— 2214142 ×	50
8.	— 211743 × 25	23.	— 9412364 ×	54
9.	— 112233 × 27	24.	— 3414123 ×	56
10.	— 333333 × 28	25.	— 2241414 ×	60
11.	— 423721 × 30	26.	— 1423421 ×	66
12.	— 177777 × 32	27.	— 2542103 ×	72
13.	— 444444 × 33	28.	— 1123421 ×	84
14.	— 555555 × 35	29.	— 4130004 ×	121
15.	— 123456 × 36	30.	— 1443043 ×	144

Proof. The excess of the 9's ejected from the product of the excess of the 9's of the two *factors*, will just equal the excess of the 9's in the *product*, if the work is right.

PRACTICAL QUESTIONS.

1. How many square feet are contained in a floor that measures 37 feet by 24 ? Ans. 888 feet.

2. How many stones, each a foot square, will pave a court that measures 99 feet in length, and 49 in breadth ? Ans. 4851 feet.

3. From Cooper in Fife to St Andrews is 9 miles, and supposing the road to be 30 feet broad; How many square yards does it contain ? Ans. 158400 sq. yds.

4. How many strokes does the hammer of a regular going clock strike in 156 days ? Ans. 24336 strokes.

5. How many balls will serve a fleet consisting of 12 ships of 96 guns, 11 do. of 90 guns, 10 do. of 84 guns, and 20 do. of 64 guns, to supply them with 144 round of shot ? Ans. 613728 balls.

6. How many yards are contained in 9 bales of cloth, each confifting of 4 parcels, each parcel of 8 pieces, and each piece of 74 yards? Anf. 21312 yards.

7. A grocer bought 96 chefts of tea, at L 19 per cheft; What was the price of the whole?
Anf. L 1824.

8. What quantity of corn will 8 men threfh in 36 days, at the rate of 3 bolls a man per day?
Anf. 864 bolls.

9. A field contains 840 fhocks of 14 fheaves each; Required the number of fheaves? Anf. 11760.

10. What number, divided by 27, will make the quotient 1.111? Anf. 29997.

11. There is a floor that meafures 50 feet by 34; Required the difference of its area, and that of 3 other floors, each ¼ of the above dimenfion? Anf. 425 fq. feet.

12. If a kingdom contains 54 counties, each county 64 parifhes, each parifh 340 families, and each family on an average 17 perfons; Required the number of perfons in the whole kingdom? Anf. 8225280.

13. How many letters are there in a book that confifts of 14 volumes, each volume of 472 pages, each page of 45 lines, and each line of 40 letters?
Anf. 11894400 letters.

14. A miller being afked how many fowls he had anfwered, I have 9 cocks; and for each cock 25 hens; and for each hen 2 chickens: moreover, each hen has 12 birds; How many had he in all? Anf. 3384.

15. How many feeds are produced from 1 plant that has 14 ftalks, each ftalk 19 pods, and each pod 6 feeds? Anf. 1596 feeds.

16. If a field of wheat, 500 yards long, be divided into 420 drills, and each yard in length of the drill to contain 4 plants, each plant 15 ftalks, and each ftalk on an average 11 grains; How many grains does the whole field contain? Anf. 13860000.

17. A certain general had under his command 36 colonels; for each colonel 16 captains; for each cap-

tain 2 lieutenants; and for each lieutenant 32 privates;
How many privates had he?   Anf. 36864.

18. How many balls will ferve 500 gun-boats, each
carrying 4 guns, fo as the whole fleet may have 99
round of fhot?   Anf. 198000.

19. In an army of 30000 men, it was found that
their pay on an average came to 2 guineas a week per
man; What fum muft be iffued monthly for their
fubfiftence?   Anf. 240000 guineas.

20. What is that gentleman's yearly income, who
has L 19 per week?   Anf. L 988.

DIVISION OF INTEGERS.

RULE I.—Place the *divifor* on the left of the *di-
vidend*, with a curved line betwixt them; find how
often it is contained in the feweft figures poffible on
the left of the *dividend*, and put the figure expreffing
the number of times in the *quotient*; multiply the *di-
vifor* by it; place the refult under the figures affumed
in the *dividend*, and fubtract it from them; to the
remainder annex the next *dividend* figure, and proceed
as above directed till the whole *dividend* is exhaufted.

EXAMPLES.

(1.) 3)74275(24758⅓

6
———
14   Mentally.

12   3|74275
———   ————
22   24758⅓

21
———
17

15
———
25

24
——
1

2. Divide 984734 by 4
3. ——— 774743 ÷ 5
4. ——— 356474 ÷ 6
5. ——— 434343 ÷ 7
6. ——— 743475 ÷ 8
7. ——— 999999 ÷ 9
8. ——— 414342 ÷ 10
9. ——— 334455 ÷ 11
10. ——— 432414 ÷ 12

$$534)942343743(1745962\tfrac{35}{534}$$

```
534
─────
 4083
 3738
─────
 2454
 2136
─────
  3183
  2670
─────
   5137
   4806
─────
    3314
    3204
─────
     1103
     1068
     ────
       35
```

Proof. The product of the divisor into the quotient, with the remainder added, will exactly equal the dividend; or by ejecting the 9's. See the Text-Book.

Divisors.	Dividends.	Quotients.	Rem.
15007	74374284127 37475472342 8	4955972	12323
84371	423742674284 774374258437	5022373	41901
571216	490184273008 300042743142	858141	403552
8874372	147434256772 101234567890	16613	431473
91004354	319876543214 223344556677	3514	87243258
12012345	151756457564 224322432243	12633	4503179

RULE II.—When there are cyphers to the right of the divisor, point them off, and an equal number of figures to the right of the dividend. Divide the remaining figures as formerly, and the quotient will be the answer. Lastly, to the remainder annex the figures pointed off from the dividend, which will make up the total remainder.

EXAMPLES.

74|000)813473|184(10992
   734
    687
     213
  Rem. 65184

94|0000)99436|7432(1057
   543
    736
  Rem. 787432

RULE III.—When there is a fraction in the divisor, multiply the integral part by the denominator, and to the product add the numerator for a new divisor; multiply the dividend by the same denominator for a new dividend, and the quotient will be the answer.

EXAMPLES.

(1.) $4\frac{1}{2}$)9729
       2
  9)19458
   2162 Anf.

(2.) $48\frac{3}{8}$)748423
        8
 387)5987384(15471
   2117
   1823
   2758
  Rem. 494

PRACTICAL QUESTIONS.

1. If 22 pieces of cloth contain in all 2046 yards; How many yards are there in each piece? Anf. 93 yds.

2. A certain county contains 124440 acres of ground, and 41480 inhabitants; How many acres are there to each?   Anf. 3 acres.

3. A gentleman has an estate of 2736 acres, which he wishes to lay out in 19 farms of equal extent; How many acres will there be in each?   Anf. 144 acres.

4. If a corn mill grind 7850 bolls in a year; What quantity is that per day?   Anf. 26 bolls.

5. A legacy of L 9500 is to be divided equally among 19 perſons; What ſum will each draw? Anſ. L 500.

6. If a regular going clock ſtrike 95640 ſtrokes in a year; How many is that per day? Anſ. 156.

7. A gentleman diſtributed L 129 among a certain number of poor people, and each got L 3; Required the number? Anſ. 43.

8. What number multiplied by 4005, will produce exactly the number 40086045? Anſ. 10009.

9. If 286 bolls are threſhed from 1430 ſhocks of wheat; How many ſhocks is that per boll? Anſ. 5 ſhocks.

10. If a field of 32 acres produce in all 416 bolls of grain; How many bolls is that per acre? Anſ. 13 bolls.

11. Suppoſe the diſtance betwixt Dunbar and Campbeltown to be 150 miles: Now, if a traveller ſets off from Dunbar to Campbeltown at the rate of 25 miles per day, and back again to Dunbar at the rate of 15 miles per day; In what time will he finiſh his journey?
Anſ. in 16 days.

12. Suppoſe 3182656 pines to be planted in an oblong field, in 32 rows, and each plant to be 7 yards diſtant from another; Required the length and breadth of the plantation, allowing 3 feet for the breadth of the fence that ſurounds it? Anſ. $\begin{cases} 696200 \text{ length} \\ 218 \text{ breadth} \end{cases}$ in yards.

13. Suppoſe a county to contain 223140 acres of land, and 74380 inhabitants; How many acres are there to each perſon? Anſ. 3 acres.

14. A captain, a mate, and 56 ſailors, capture a prize of L 40020, which, according to agreement, is to be ſhared equally among all the men on board; What ſum will each draw? Anſ. L 690.

15. If the inhabitants of a city conſume 350400 bolls of wheat in a year; How much is that per week, and per day? Anſ. $\begin{cases} 960 \text{ per day.} \\ 6738\frac{6}{11} \text{ per week.} \end{cases}$

B

STERLING MONEY.

4 Farthings = 1 Penny.
12 Pence = 1 Shilling.
20 Shillings = 1 Pound.

TROY WEIGHT.

24 Grains = 1 Penwt.
20 Penwt. = 1 Ounce.
12 Ounces = 1 Pound.

APOTHECARIES WEIGHT.

20 Grains = 1 Scruple.
3 Scruples = 1 Dram.
8 Drams = 1 Ounce.
12 Ounces = 1 Pound.

AVOIRDUPOISE WEIGHT.

16 Drams = 1 Ounce.
16 Ounces = 1 Pound.
28 Pounds = 1 Quarter.
4 Quarters = 1 Cwt.
20 Cwt. = 1 Ton.

DRY MEASURE.

4 Lippies = 1 Peck.
4 Pecks = 1 Firlot.
4 Firlots = 1 Boll.
16 Bolls = 1 Chalder.

SCOTS LAND MEASURE.

36 Ells = 1 Fall.
40 Falls = 1 Rood.
4 Roods = 1 Acre.

SCOTS LIQUID MEASURE.

4 Gills = 1 Mutchk.
2 Mutchks. = 1 Chopin.
2 Chopins = 1 Pint.
2 Pints = 1 Quart.
4 Quarts = 1 Gallon.
16 Gallons = 1 Hhd.

WINE MEASURE.

2 Pints = 1 Quart.
4 Quarts = 1 Gallon.
63 Gallons = 1 Hhd.
2 Hhds. = 1 Pipe or Butt.
2 Pipes = 1 Ton.

CLOTH MEASURE.

4 Nails = 1 Quarter.
4 Quarters = 1 Yard.
3 Quarters = 1 Ell Flem.
5 Quarters = 1 Ell Eng.

LONG MEASURE.

3 Barleycs. = 1 Inch.
12 Inches = 1 Foot.
3 Feet = 1 Yard.
5½ Yards = 1 Pole.
40 Poles = 1 Furlong.
8 Furlongs = 1 Mile.
3 Miles = 1 League.

PAPER AND PARCHMENT.

24 Sheets = 1 Quire.
20 Quires = 1 Ream.
10 Reams = 1 Bale.

YARN.

120 Threads = 1 Cut.
2 Cuts = 1 Heer.
6 Heers = 1 Hank.
4 Hanks = 1 Spindle.

DOZENS.

12 Units = 1 Dozen.
12 Dozen = 1 Grofs.
12 Grofs = 1 Great Grofs.

TIME.

60 Seconds = 1 Minute.
60 Minutes = 1 Hour.
24 Hours = 1 Day.
7 Days = 1 Week.
4 Weeks = 1 Month.
13 Months = 1 Year.

CATALOGUE OF MEMORANDUMS.

	L.	s.	d.		L.	s.	d.
Guinea -	1	1	0	Frederic-d'or	0	17	6
Crown -	0	5	0	Gold Rupee	1	15	0
Moidore -	1	7	0	Dollar	0	4	6
Jacobus -	1	5	0	Ducat	0	9	4
Carolus -	1	3	0	Livre	0	0	10
Mark - -	0	13	4	Piſtole	0	8	4
An Angel	0	10	0	Piſtole of Ex.	0	18	0
Guilder -	0	1	10	Ruble	0	4	6
Dry Guilder	0	5	3	Sequin of Ven.	0	9	$5\frac{3}{4}$
Louis-d'or	1	0	0				

$35\frac{1}{4}$ Cubic Inches - - = 1 Pint of ale and beer.
282 Do. - - - - = 1 Gallon do.
231 Do. - - - - = 1 Gallon of wine.
$103\frac{2}{3}$ Do. - - - - = 1 Scots Pint.
$2150\frac{2}{5}$ Do. - - - - = 1 Corn or malt Buſhel.
2203 Do. - - - - = 1 Wheat Firlot.
$28\frac{7}{8}$ Do. - - - - = 1 Pint of wine.
$21\frac{1}{4}$ Scots Pints - - - = 1 Wheat Firlot.
2240 lib. Avoirdupoiſe = 1 Ton.
10 Quarters, or 80 Buſhels, = 1 Laſt of corn.
8 lib. Amſterdam weight = 1 Peck of meal.

240 lib. Avoirdupoife - — 1 Sack of flour.
4.0873 Winchester Bufhels — 1 Boll of wheat.
5.9626 Do. - - - — 1 Boll of barley.
48 Cubic Feet of timber — 1 Ton.
40 Do. - - - - — 1 Ton, carpenter's meaf.
1 Square mile contains 640 Englifh Acres; or 537 Acres, 3 Roods, 4 Falls, and 16 Ells, Scots measure.
2 Pints and ½ Gill Scots, make 3 Fnglifh Ale Quarts.

REDUCTION BY MULTIPLICATION.

RULE.—Multiply the given number continually by its equivalent in the next inferior denomination, adding in course the number thereto belonging (if any), and the laft product will be the anfwer.

EXAMPLES.

1. Red. L 74 13 4¼ to farthings.
         20
   ────────────
   1493 fhillings.
         12
   ────────────
   17920 pence.
          4
   ────────────
   71681 farthings.

2. Red. L 412 17 to pence and farthings.
                        Anf. 99084d.   396336 f.
3. ——84 lib. 9 oz. Troy, to grains.   Anf. 488160.
4. ——9 ton, 12 cwt. to pounds.   -   Anf. 21504.
5. ——112 chald. 9 bolls, to lippies.   Anf. 115264.
6. ——409 acres, 3 roods, to ells.   Anf. 2360160.
7. ——333 yards, 3 nails, to nails.   -   Anf. 5331.
8. ——412 years, 7 min. to fec.   Anf. 12957235620.
9. ——777 guin. 7 pence, to farth.   Anf. 783244.
10. ——443 crowns, 2 fhil. to pence.   Anf. 26604.
11. ——111 pipes, 9 gal. wine, to pints. Anf. 111960.

12. Red. 471 ells, 1 qr. Flem. to nails. Anſ. 5656.
13. ——— 999 ells Engliſh to nails. - Anſ. 19980.
14. ——— 404 cwt. 3 qrs. to pounds. Anſ. 45332.
15. ——— 154 lib. 9 oz. Apoth. to ſcrup. Anſ. 44352.
16. ——— 49 years, 3 weeks, to ſec. Anſ. 1542844800.
17. ——— 557 miles, 20 poles, to barleycorns.
Anſ. 105886440.
18. ——— 12 ream, 10 quires, to ſheets. Anſ. 6000.

REDUCTION BY DIVISION.

RULE.—Divide the given number continually by its equivalent in the next inferior denomination, and the laſt quotient will be the anſwer.

EXAMPLES.

1. Red. 71681 farthings to pence, ſhil. and pounds.

4|71681
12|17920¼
2|0|1493 4
Anſ. L. 74 13 4¼

2. Red. 7798 farth. to cr. &c. Anſ. 32 cr. 2s. 5½d.
3. ——— 484360 grs. to pounds Apoth.
Anſ. 84 lib. 1 oz. 2 ſcr.
4. ——— 34776 grs. to pounds Troy. Anſ. 6 lib. 9 dwt.
5. ——— 8070592 drams to tons, &c.
Anſ. 14 ton, 1 cwt. 1 qr. 25 lib. 12 oz.
6. ——— 347596 lip. to chald. Anſ. 339 ch. 7 b. 3 p.
7. ——— 80028 ſq. ells to ac. &c. Anſ. 13 ac. 3 r. 23 f.
8. ——— 88888 farth. to guin. Anſ. 88 guin. 3s. 10d.
9. ——— 90972 lib. to tons, &c. Anſ. 40 t. 12 cwt. 1 qr.
10. ——— 12957235620 ſec. to yrs. Anſ. 412 yrs. 7 min.
11. ——— 783244 farth. to guin. Anſ. 777 guin. 7d.
12. ——— 26604 pence to crowns. Anſ. 443 cr. 2s.

B 3

13. Red. 111960 pts. wine to tons. Anf. 111 pipes, 9 gal.
14. ——— 5656 nails to ells Flem. Anf. 471 ells, 1 qr.
15. ——— 19980 nails to ells Englifh. Anf. 999 ells.
16. ——— 45332 lib. to cwts. &c. Anf. 404 cwt. 3 qrs.
17. ——— 1542844800 fec. to yrs. &c. Anf. 49 yrs. 3 w.
18. ——— 105886440 b. c. to miles. Anf. 557 m. 20 p.
19. ——— 6000 fheets to reams. Anf. 10 ream, 10 quires.
20. ——— 21504 lib. to tons, &c. Anf. 9 ton. 12 cwt.
21. ——— 74347 cuts to hanks and fpindles.

Anf. 1548 fp. 3 h. 3 h. 1 cut.

CONJOINT OR MIXT REDUCTION.

When a number of any propofed denomination cannot be reduced to the name required by multiplication or divifion alone, both rules muft be ufed promifcuoufly; and this we call conjoint or mixt reduction.

RULE.—Reduce the given number to fuch a denomination by the one, as may by the other be brought to the denomination required.

EXAMPLES.

1. Red. 544 dollars, at 4s. 9d. each, to pounds fterl.

            544
             57 pence in a dollar.
           ————
           3808
           2720
           ————
    12|31008 pence in the given number of dol.
    2|0|2584 fhil. in do.
         L 129 4

2. Red. 784 moidores, at 27s. to pounds fterl.

Anf. L 1009 16.

3. ——— L 1009 16 to moi. at 27s.   Anf. 784 moi.
4. ——— 408 moi. at 26s. 6s. to guin. Anf. 514 g. 16s.

5. Red. 733 crowns to pounds. Anf. L 183 5.

6. ——1481 qr. guin. to moi. at 26s: 6d. Anf. 293$\frac{43}{106}$ m.

7. —— 8440 bitts of Jamaica, at 4d. to crowns.

Anf. 562 cr. 3s. 4d.

8. How often will a wheel of 18 feet circumference turn round its axis in running betwixt Cooper and King-horn, the diſtance being 22 miles? Anf. 6453$\frac{1}{3}$ times.

9. Required the number of turnings that a wheel of 22 feet circumference will make in running 100 miles?

Anf. 24000.

10. A traveller had 32 purſes; in each of which was a moidore, a guinea, a crown, a dollar, and a gold rupee; How many pounds ſterling had he? Anf. L 148.

11. How many Britiſh ſtatute miles are equal to 750 geographical ones, 69$\frac{1}{2}$ of the former being equal to 60 of the latter? Anf. 868 miles, 6 fur.

12. A gentleman diſtributed L 129 among a certain number of poor people, and each got 3s.; Required the number? Anf. 860 people.

13. Bought 47 ſheep at 19s. each; What did the price of the whole amount to? Anf. L 44 13.

VULGAR FRACTIONS.

DEF. I.—A fraction is a part of an unit, ariſing from diviſion, and ſuppoſes the unit to be divided into ſome certain number of equal parts. It is expreſſed by two terms; the one wrote above a line, called the *numerator*, the other under the ſame line, called the *denominator*, and both together conſtitute the fraction; as $\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{9}{13}$, &c.

II.—*A proper fraction* is, when the numerator is leſs than the denominator; as $\frac{1}{4}$, $\frac{5}{9}$, &c.

III.—*An improper fraction* is, when the numerator is equal to, or greater than the denominator; as $\frac{6}{6}$, $\frac{8}{7}$, $\frac{12}{5}$, &c.

IV.—*A compound fraction* is the fraction of a fraction, and is always expreſſed by the word *of*; as $\frac{3}{4}$ of $\frac{5}{7}$ of $\frac{8}{11}$, &c.

V.—*A mixt number* is compoſed of an integer and a fraction; as 8$\frac{1}{2}$, 9$\frac{3}{4}$, 127$\frac{3}{8}$, &c.

Prob. I.—*To reduce a whole number to a fraction of an assigned denominator.*

Rule I.—Multiply the whole number into the assigned denominator for a numerator, and draw a line under it.

II.—Place the assigned denominator under the line, to complete the fraction.

EXAMPLES.

1. Red. 5 to a fraction whose denominator shall be 7.

$$7 \times 5 = \tfrac{35}{7} \text{ Ans.}$$

2. —— 6 to a fraction whose denominator shall be 8.

$$8 \times 6 = \tfrac{48}{8} \text{ Ans.}$$

3. —— 19 to a fraction whose denominator shall be 21.

Prob. II.—*To reduce improper fractions to equivalent whole or mixt numbers.*

Rule I.—Divide the numerator by the denominator, the quotient will be the integral part ; and when there is no remainder, will be the answer.

II.—When there is a remainder, place it on the right of the integral part, with the divisor under it, and a line betwixt them, and both together will constitute the mixt number.

EXAMPLES.

1. Red. $\tfrac{108}{9}$ to a whole or mixt number.

$$108 \div 9 = 12 \text{ Ans.}$$

2. —— $\tfrac{121}{3}$ to a whole or mixt number. $40\tfrac{1}{3}$ Ans.

3. —— $\tfrac{172}{5}$ to a whole or mixt number. $34\tfrac{2}{5}$ Ans.

Prob. III.—*To reduce a mixt number to an improper fraction.*

Rule I.—Multiply the integral part by the denominator, and to the product add the numerator for a new numerator.

II.—Under this new numerator place the old denominator, with a line betwixt them, to complete the fraction.

1. Red. $5\frac{3}{4}$ to an improper fract. $5 \times 4 + 3 = \frac{23}{4}$ Anf.

2. —— $71\frac{1}{3}$ to an improper fract. - - $\frac{358}{5}$ Anf.

3. —— $12\frac{1}{7}$ to an improper fract. - - $\frac{85}{7}$ Anf.

PROB. IV.—*To reduce a compound fraction to a simple one.*

RULE I.—Multiply the numerators continually for a numerator.

II.—Multiply the denominators continually for a denominator.

EXAMPLES.

1. Red. $\frac{4}{5}$ of $\frac{8}{9}$ to a simple fract. - $\frac{4}{5} \times \frac{8}{9} = \frac{32}{45}$ Anf.

2. —— $\frac{4}{7}$ of $\frac{8}{11}$ of $\frac{3}{5}$ to a simple fract. - Anf. $\frac{96}{385}$.

3. —— $\frac{3}{5}$ of $\frac{4}{5}$ of $\frac{3}{7}$ to a simple fract. - Anf. $\frac{36}{175}$.

4. —— $\frac{4}{7}$ of $\frac{8}{9}$ of 12 to a simple fract. - Anf. $\frac{384}{63}$.

PROB. V.—*To reduce a fraction to its lowest terms.*

RULE I.—Find a common meafure by dividing the denominator by the numerator and the divifor by the remainder continually, till nothing remain, and the laft divifor will be the common meafure.

II. Divide both numerator and denominator by the common meafure, and the two quotients will be the members of the new fraction in its loweft terms.

EXAMPLES.

1. Red. $\frac{132}{348}$ to its loweft terms.

```
132)348(2
     264            Then 12)132(11 the Anf.
            — — — — — — — — — —  348    29
     84)132(1
        84
        — — —
        48)84(1
           48
           — — —
           36)48(1
              36
              — — —
              12)36(3
                 36
```

2. Red. $\frac{2548}{2912}$ to its loweſt terms. - - - Anſ. $\frac{7}{8}$.

3. —— $\frac{480}{940}$ to its loweſt terms. - - - - Anſ. $\frac{24}{47}$.

PROB. VI.—To reduce a fraction of one denomination to another.

If from a lower to a higher;—RULE.—Multiply the denominator by as many of the lower as make one of higher: If from a higher to a lower;—RULE.—Multiply the numerator by the above-mentioned number or numbers.

EXAMPLES.

1. Red. $\frac{4}{7}$ of a farthing to the fraction of a pound.
$$\frac{4}{7}\times\frac{1}{4}\times\frac{1}{12}\times\frac{1}{20}=\frac{4}{6720} \text{ Anſ.}$$

2. —— $\frac{3}{5}$ of a farth. to the fract. of a L. Anſ. $\frac{3}{4800}$.

3. —— $\frac{7}{9}$ of a lippie to the fract. of a chald. Anſ. $\frac{7}{9216}$.

4. —— $\frac{4}{7}$ L to the fract of a penny. $4\times 20\times 12=\frac{960}{7}$.

5. —— $\frac{4}{5}$ lib. Troy to the fract. of a grain. Anſ. $\frac{23040}{5}$.

6. —— $\frac{8}{9}$ of a yard to the fract. of a nail. Anſ. $\frac{128}{9}$.

7. —— $\frac{5}{12}$ of a pound to the fraction of a guinea.
   Operation. $\frac{5}{12}\times\frac{20}{21}=\frac{100}{252}$ Anſ.

8. —— $\frac{4}{7}$ of a crown to the fraction of a pound.
   Operation. $\frac{4}{7}\times\frac{5}{20}=\frac{20}{140}$ Anſ.

9. —— $\frac{3}{8}$ of a moidore to the fract. of a pound. Anſ. $\frac{81}{160}$.

10. —— $\frac{7}{8}$ of a guin. to the fract. of a crown. Anſ. $\frac{147}{40}$.

11. —— $\frac{1}{4}$ Jacobus to the fract. of a pound. Anſ. $\frac{25}{80}=\frac{5}{16}$.

12. —— $\frac{3}{5}$ of a noble to the fract. of do. Anſ. $\frac{240}{1200}=\frac{1}{5}$.

13. —— $\frac{4}{7}$ of a piſtole of Ex. to the fract. of a guinea.
   Anſ. $\frac{24}{49}$.

PROB. VII.—To reduce fractions of different denominators to others of the same value, having one common denominator.

RULE I.—Multiply each numerator into the denominators continually (its own excepted) for a numerator.

II.—Multiply the denominators continually, and the product will be the common denominator.

EXAMPLES.

1. Red. $\frac{3}{4}$, $\frac{4}{5}$, and $\frac{5}{6}$ to fractions of the same value, having one common denominator.

$$
\left.
\begin{array}{l}
3 \times 5 \times 6 = 90 \\
4 \times 4 \times 6 = 96 \\
5 \times 4 \times 5 = 100
\end{array}
\right\} \text{ numerators } \quad \text{makes}
\left\{
\begin{array}{l}
\frac{90}{120} = \frac{3}{4} \cdot \\
\frac{96}{120} = \frac{4}{5} \cdot \\
\frac{100}{120} = \frac{5}{6} \cdot
\end{array}
\right.
$$

$4 \times 5 \times 6 = 120$ common denom.

2. ——— $\frac{3}{7}$, $\frac{8}{9}$, $\frac{4}{5}$ to a com. denom. Anf. $\frac{135}{315}$, $\frac{280}{315}$, $\frac{252}{315}$.

3. ——— $\frac{4}{11}$, $\frac{8}{13}$, $\frac{9}{10}$ to a com. den. Anf. $\frac{520}{1430}$, $\frac{880}{1430}$, $\frac{1287}{1430}$.

Prob. VIII.—To find the value of a fraction.

RULE.—Multiply the numerator into the inferior denominations one after another, beginning at the highest, and divide the several products by the denominator and the quotient will be the value required.

EXAMPLES.

1. Req. the value of $\frac{31}{40}$ of a pound sterling?

$$
\frac{31 \times 20 \times 12}{40} = 15s.\ 6d.\ \text{Anf.}
$$

2. ——— of $\frac{4}{15}$ of a pound? Anf. 3s. $2\frac{1}{4}$d. $\frac{2}{5}$.

3. ——— of $\frac{7}{8}$ of a guinea? Anf. 18s. $4\frac{1}{2}$d.

4. ——— of $\frac{8}{11}$ of a chalder? Anf. 1 1b. 2 f. $2\frac{2}{11}$p.

5. ——— of $\frac{9}{16}$ of a lib. Troy? Anf.

ADDITION OF VULGAR FRACTIONS.

PREPAR. I.—Reduce mixed numbers to improper fract.

II.—Reduce compound fractions to simple ones.

III.—Reduce fractions of different denominations to others of the same integer.

IV.—Red. fractions of different denominators to others of the same value, having one common denominator.

RULE.—Add all the numerators into one sum; under which write the common denominator for the answer.

1. Add $\frac{5}{7}, \frac{6}{7}, \frac{4}{7}$. *Operation.* $5+6+4=\frac{15}{7}=2\frac{1}{7}$ Anſ.

2. —— $\frac{3}{4}$ of a pound, $\frac{2}{3}$ of a ſhilling, and $\frac{3}{4}$ of a penny.

$$\frac{2}{3} \times \frac{1}{20} = \frac{2}{60} \text{ L.}$$

$$\frac{3}{4} \times \frac{1}{12} \times \frac{1}{20} = \frac{3}{960} \text{ L.}$$

Then $3 \times 60 \times 960 = 172800$

$2 \times 4 \times 960 = 7680$

$\underline{3 \times 4 \times 60 = 720}$

181200

$\underline{4 \times 60 \times 960 = 230400} = 15\text{s. } 8\frac{3}{4}\text{d. Anſ.}$

3. Add $9\frac{1}{4}$ to $12\frac{4}{5}$. - - - - - - Anſ. $22\frac{1}{20}$

4. —— $7\frac{3}{7}$ to $9\frac{1}{4}$ and $\frac{3}{4}$ of $\frac{8}{9}$. - - - Anſ. $17\frac{29}{84}$

5. —— $\frac{4}{5}$ and $\frac{3}{4}$ of a L, and $\frac{3}{4}$ of a ſhil. Anſ. L 1 11 9.

6. —— $\frac{5}{6}$ of a guin. $\frac{1}{8}$ of a moi. and $\frac{2}{3}$ of a crown.

Anſ. L 1 4 $2\frac{1}{7}$

7. —— $9\frac{1}{5}$ yds. $3\frac{3}{8}$ qrs. and $3\frac{1}{4}$ nails. Anſ. 10 yds. $2\frac{19}{20}$ n.

8. —— L $9\frac{1}{7}$, L $7\frac{3}{7}$, $3\frac{4}{5}$ guin. and $6\frac{4}{9}$ crowns.

Anſ. L 22 3 $5\frac{1}{4}$ $\frac{67}{105}$

9. —— $9\frac{1}{4}$ cwt. $8\frac{1}{2}$ do. $5\frac{3}{8}$ do. and $\frac{2}{3}$ of a qr.

Anſ. 23 cwt. 1 qr. $4\frac{2}{3}$ lib.

SUBTRACTION OF VULGAR FRACTIONS.

RULE.—Prepare the fractions as in addition ; then will the difference of the numerators, ſet over the common denominator, be the anſwer required.

EXAMPLES.

1. What is the difference of $\frac{7}{12}$ and $\frac{11}{12}$?

Operation. $11 - 7 = \frac{4}{12}$ Anſ.

2. ———————————— of $\frac{3}{4}$ and $\frac{5}{8}$?

$8 \times 3 = 24$

$\underline{4 \times 5 = 20}$

4

$8 \times 4 = 32 = \frac{1}{8}$ Anſ.

3. From $19\frac{2}{3}$ take $13\frac{6}{7}$. - - - - - - Anſ. $5\frac{17}{21}$

4. —— $9\frac{4}{5}$ take $4\frac{1}{7}$ and $\frac{3}{4}$ of $\frac{2}{11}$. - - Anſ. $5\frac{401}{770}$

5. —— 21 take $\frac{4}{5}$ of $\frac{3}{4}$ of $\frac{8}{9}$. - - - Anſ. $20\frac{21}{45}$

6. From $\frac{19}{20}$ take $\frac{7}{8}$ of $\frac{4}{7}$. - - - - - Anſ. $\frac{9}{20}$.

7. —— $\frac{3}{4}$ of a pound take $\frac{3}{4}$ of a ſhil. Anſ. $\frac{17}{20}$=14s. 3d.

8. —— $17\frac{1}{2}$ chald. take $13\frac{3}{4}$ bolls. - - Anſ.

9. —— $\frac{8}{9}$ of a guin. take $\frac{3}{4}$ of a pound. Anſ. 3s. 8d.

10. What is the difference betwixt $\frac{7}{8}$ and $\frac{8}{9}$, and which of the two is the greateſt fraction? Anſ. $\frac{8}{9}$ and $\frac{1}{72}$ is dif.

MULTIPLICATION OF VULG. FRACTIONS.

RULE.—Prepare the fractions as in addition; then the product of the numerators ſet over the product of the denominators, will be the anſwer.

EXAMPLES.

1. Mult. $\frac{8}{11}$ by $\frac{5}{12}$. Operation. $\frac{8}{11} \times \frac{5}{12} = \frac{40}{132} = \frac{10}{33}$ Anſ.

2. Req. the continued prod. $\frac{3}{4}$, $\frac{4}{7}$, $\frac{5}{8}$, $\frac{6}{7}$? - Anſ. $\frac{1}{7}$.

3. ——————— $8\frac{4}{5}$, $1\frac{1}{4}$, and $\frac{5}{6}$ of $\frac{1}{3}$? Anſ. $4\frac{21}{216}$.

4. Mult. $8\frac{1}{5}$ by $3\frac{1}{4}$. - - - - - - Anſ. $26\frac{13}{20}$.

5. —— $48\frac{1}{4}$ by $7\frac{1}{3}$. - - - - - - Anſ. $353\frac{5}{6}$.

6. —— $14\frac{1}{3}$ by $\frac{3}{4}$ of $\frac{3}{4}$ of $\frac{1}{7}$. - - - Anſ. $2\frac{13}{448}$.

7. What is the price of $18\frac{1}{4}$ yds. of India muſlin, at 9s. $4\frac{3}{5}$d. per yard? - - - - Anſ. L 8 11 $2\frac{3}{4}\frac{4}{5}$.

8. How many ſquare feet are there in a floor that is $21\frac{1}{3}$ feet long and $15\frac{1}{4}$ broad? - Anſ. $325\frac{1}{3}$ feet.

DIVISION OF VULGAR FRACTIONS.

RULE.—Prepare the fractions as in multiplication; then multiply the denominator of the diviſor into the numerator of the dividend for a numerator, and the numerator of the diviſor into the denominator of the dividend for a denominator to the quotient.

EXAMPLES.

1. Divide $\frac{4}{5}$ by $\frac{3}{4}$. Operation. $\frac{3}{4})\frac{4}{5}(\frac{16}{15}=1\frac{1}{15}$ Anſ.

2. —— $\frac{11}{12}$ by $\frac{3}{5}$. - - - - - - - Anſ. $1\frac{19}{36}$.

3. —— $13\frac{1}{2}$ by $3\frac{1}{5}$. - - - - - - Anſ. $3\frac{39}{72}$.

4. —— $73\frac{1}{2}$ by $\frac{3}{5}$ of $\frac{7}{8}$. - - - - - Anſ. 140.

C

5. Divide $123\frac{1}{7}$ by $11\frac{1}{8}$. - - - - Anſ. $11\frac{43}{62\cdot7}$.

6. —— $\frac{3}{4}$ of 7 by $\frac{2}{8}$ of 11. - - - - Anſ. $1\frac{19}{11}$.

7. What number multiplied by $9\frac{4}{7}$, will make the pro-duct $20\frac{1}{21}$? - - - - - - - - Anſ. $2\frac{47}{1029}$.

8. Bought $142\frac{2}{5}$ yds. linen, at L $28\frac{4}{7}$; What did it coſt me per yard? - - - - - Anſ. $4\frac{8}{62\cdot78}$.

9. —— $93\frac{3}{8}$ broad cloth, at L $64\frac{3}{5}$; What muſt I ſell it at per yard, to gain L $8\frac{4}{5}$ on the whole?

Anſ. 15s. $8\frac{1}{2}$d. $\frac{474}{747}$.

COMPOUND ADDITION.

RULE I.—Place denominations of the ſame kind under each other, and draw a line under them.

II.—Begin at the loweſt; and having found its ſum, carry by as many as make one of the next ſuperior, and write down the exceſs (if any) under the denomination added.

III.—Proceed in the ſame manner through all the de-nominations till the laſt, in which carry at 10 as in inte-gers.

A MEMORANDUM TABLE.

FARTHINGS.		PENCE.		SHILLINGS.	
far.	d.	d.	s.	s.	L.
4 = 1		12 = 1		20 = 1	
8 = 2		24 = 2		40 = 2	
12 = 3		36 = 3		60 = 3	
16 = 4		48 = 4		80 = 4	
20 = 5		60 = 5		100 = 5	
24 = 6		72 = 6		120 = 6	
28 = 7		84 = 7		140 = 7	
32 = 8		96 = 8		160 = 8	
36 = 9		108 = 9		180 = 9	
40 = 10		120 = 10		200 = 10	
44 = 11		132 = 11		220 = 11	
48 = 12		144 = 12		240 = 12	

EXAMPLES.

STERLING MONEY.				TROY WEIGHT.			
L.	s.	d.		lib.	oz.	dwt.	grs.
443	15	$4\frac{1}{4}$		774	10	14	13
344	17	$5\frac{1}{2}$		347	11	14	15
434	14	$8\frac{3}{4}$		443	9	13	14
747	13	$7\frac{1}{2}$		340	4	19	12
845	12	$9\frac{1}{4}$		474	7	19	11
442	15	$4\frac{3}{4}$		374	8	14	14
233	13	$0\frac{1}{4}$		434	9	14	13
3493	2	$4\frac{1}{4}$					

Note. The learner is here understood to work a few examples under each of the tables of coin, weight, &c. and then proceed to the following

PRACTICAL QUESTIONS.

1. Borrowed of A L 140; of B L 372 14 9; of C L 412 13 4½; of D L 48 17 3¾; and of E L 441 11 11¼; What sum have I borrowed in all? Ans. L 1417 17 5.

2. A grocer has in cash L 48 12 4; teas to the value of L 142 17 3; sugars L 99 13 7½; fruits L 111 11 11; confections L 48 19 2¼; gin L 27 12 4; rum L 108 8 3½; Req. the amount of his stock in trade? Ans. L 587 14 11¼.

3. The appraisation of a farmer's stocking and crop is as under, viz. horses L 96 15; cows L 65 9 6; yearlings L 49 17 4; calves L 26 13 4; sheep L 24 5; wheat L 182 10; barley L 97 4; oats L 150 12 4; potatoes L 14 7 6; pease L 6 6; What does the whole amount to? - - - - - - - - - - Ans. L 714.

4. A woollen-draper has on hand the following quantities of cloth, viz. blues 149 yds. 2 qrs. 3 nails; greens 84 yds. 3 nails; various mixtures 241 yds. 1 qr. 2 nails; scarlets 100 yds. 1 qr.; browns 123 yds. 2 qrs.; blacks 90 yds. 1 nail; flannels 217 yds. 2 qrs.; serges and shalloons 82 yds. 2 qrs. 2 nails; How many yds. has he in all?
Ans. 1089 yds. 3 nails.

5. Bought a horse at L 22 15; a cow at L 9 12 6;

C 2

a bull at L 8 8 9; a mare at L 17 17 6; an ox at L 13 10; an aſs at L 7 9 9½; a ram at L 1 3 4½; and a goat at L 2 1; What ſum paid the account? Anſ. L 82 17 11.

6. A father bequeathed his eſtate to his 3 ſons, Adam, Arthur, and Oliver, as follows, viz. Adam got L 4009 14 6¼; Arthur L 2909 15 9½; and Oliver L 2000 9 8¼; Req. the val. of the eſtate? Anſ. L 8920.

7. A vintner has in his cellar as under, viz. claret to the val. of L 200 15; ſherry L 140 10 6; port L 120 12 6; rum L 170 15 6; gin L 19 14 9; whiſky L 136 9 6; ſhrub and cyder L 18 1 6; and porter L 30 9; Req. the value of the whole? - - - - Anſ. L 837 8 3.

8. A builder paid for ground L 172 15; the maſon's bill was L 444 4 4; the carpenter's L 511 5 6; the ſlater's L 104 9 6½; the ſmith's L 19 4 2½; the glazier's L 49 8 4½; What does the houſe coſt him when finiſhed? Anſ. L 1301 6 11½.

9. Suppoſe a collector ſhould receive at Cooper-Fife L 2480 12 7¼; at St Andrews L 2504 13 4½; at Crail L 840 15 9; at Anſtruther L 1004 17 5¼; at Pitten-weem L 990 12 8½; at Ely L 711 4 5; at Largo L 519 7; at Leven L 914 19; at Wemyſs L 399 7 6; at Dyſart L 1009 9 9; at Kirkaldy L 999 19 9½; at Kinghorn L 710 12 4; at Burntiſland L 1111 11 11¼; at Inverkeithing L 2000 14; at Limekilns L 919 16 4; at Torryburn L 770 18 11; and at Dunfermline L 4111 12 7¼; Req. the ſum of the collection? Anſ. L 22001 5 6.

COMPOUND SUBTRACTION.

RULE I.—Place denominations of the ſame kind un-er each other, and draw a line below them.

II.—Begin at the right, and ſubtract the numbers in each denomination of the ſubtrahend from thoſe cor-reſponding to them in the minuend, remembering to bor-row in any denomination according to the number of times it is contained in the next ſuperior.

EXAMPLES.

STERLING MONEY.				TROY WEIGHT.			
	L.	s.	d.		lib.	oz.	dwt. grs.
From	884	12	$5\frac{1}{2}$	From	777	0	0　0
Take	587	14	$7\frac{1}{4}$	Take			1　14
Rem.	296	17	$10\frac{1}{4}$	Rem.	776	11	18　10
Proof	884	12	$5\frac{1}{2}$	Proof	777	0	0　0

Note. As in addition, so likewise here, the student is directed to work a few examples under each table, and then proceed to the following questions.

1. Borrowed L 7004 13 4, and paid L 900 12 $9\frac{1}{4}$; Req. the balance due? - - - Ans. L 6104 0 $6\frac{3}{4}$.

2. If a gentleman's yearly income amounts to L 43140, and his assessed taxes, &c. to L 2948 9 $4\frac{1}{2}$; What sum does he nett annually? - - - Ans. L 40191 10 $7\frac{1}{2}$.

3. Bought 4047 yds. broad cloth, and have sold 2989 yds. 1 qr, 2 nails; What quantity remains?
Ans. 1057 yds. 2 qrs. 2 nails.

4. A gentleman has an estate of 7045 acres; he has let in tack to sundry tenants 6851 acres, 1 rood, 13 falls, 17 ells; What quantity does he retain in his own possession? - - - - - Ans. 193 ac. 2 r. 26 f. 19 ells.

5. Lent John Trader L 400; Req. the balance due after having received from him goods to the amount of L 213 13 $9\frac{1}{2}$? - - - - - - - Ans. L 186 6 $2\frac{1}{2}$.

6. A merchant took a lease of a shop for a certain time, for which he was to pay in all L 400 15. He paid at entry L 194 17 $4\frac{1}{2}$; some time after L 149 19 $10\frac{1}{2}$; and the balance is to be paid at the end of the lease; What does it amount to? - - - Ans. L 55 17 9.

7. Suppose a merchant's whole debts amount to L 3011 16 4; his goods on hand to L 840 14 $9\frac{1}{4}$; bills L 598 12 7; accounts due to him L 407 7 7; Req. his total deficiency? - - - - - - Ans. L 1165 1 $4\frac{1}{2}$.

8. Three thousand acres of common are to be divided among 3 men, viz. A, B, and C; of which A is to have 790 acres, 1 rood, 18 ells; B 1040 acres, 3 roods, 14

falls, 27 ells ; What quantity will fall to C's fhare ?

<div align="right">Anf. 1168 ac. 3 r. 24 f. 27 ells.</div>

9. G and X together bought 37 cwt. 1 qr. of fugar, of which G took 21 cwt. 1 qr. 17 lib. ; How much remained to X ? - - - - Anf. 15 cwt. 3 qrs. 25 lib.

10. Subtract 3 lib. from 500 ton.

<div align="right">Anf. 499 ton, 19 cwt. 3 qrs. 25 lib.</div>

COMPOUND MULTIPLICATION.

RULE I.—Place the multiplier under the loweft denomination of the multiplicand ; by it multiply the feveral denominations therein, and carry according to the local value of each.

EXAMPLES.

1. What is the price of 4 pipes wine, at L 37 15 6¾ each ?

$$L 37 \quad 15 \quad 6\tfrac{3}{4}$$
$$4$$

<div align="center">Anf. L 151   2   3⁹⁄₄</div>

2. Calculate 6 cwt. at L 3 17 6 per cwt. Anf. L 23 5.

3. ——— 7 cwt. at L 4 1 9½.   Anf. L 28 12 6½.

4. ——— 8 acres, at L 36 9 6. - Anf. L 291 16.

5. ——— 9 hhds. at L 5 9 3. - Anf. L 49 3 3.

6. ——— 10 yds. at L 1 1 3. - Anf. 10 12 6.

7. ——— 11 cwt. at L 7 7 7. - - Anf. 81 3 5.

8. ——— 12 acres, at L 42 3 7. - Anf. L 506 6.

9. ——— 12 cwt. at L 7 7 7. - Anf. L 88 11.

10. ——— 12 yds. at L 1 4 4. - Anf. L 14 12.

11. ——— 12 hhds. at L 8 7 11. - Anf. 100 15.

12. Mult. 8 cwt. 3 qrs. 12 lib. by 2.

<div align="right">Anf. 17 cwt. 2 qrs. 24 lib.</div>

13. ——— 7 ac. 3 r. 19 f. by 4. Anf. 31 ac. 1 r. 36 f.

14. ——— 9 chald. 7 b. 3 firl. by 5. Anf. 47 ch. 6 b. 3 f.

15. ——— 144 yds. 3 qrs. 2 nails by 8. Anf. 1159 yds.

16. ——— 36 doz. 9 partic. by 9. Anf. 330 doz. 9 part.

RULE II.—When the multiplier exceeds 12, and is the rectangle of any two or more numbers, neither of

which exceed 12, multiply by thefe numbers or compo-
nent parts fucceffively.

1. What is the price of 96 yds. of linen, at 4s. $7\frac{1}{2}$d. per yard?

$$4 \quad 7\frac{1}{2}$$
$$12$$

Thus. $\quad 2 \quad 15 \quad 6\frac{0}{4} = 12$ yds.

$$8$$

L 22 $\quad$ 4 $\quad$ $0\frac{0}{4} = 96$ yds.

Or thus. $\quad 4 \quad 7\frac{1}{2}$ $\qquad$ Or thus. $\quad 4 \quad 7\frac{1}{2}$

$$4 \qquad\qquad\qquad\qquad 8$$

18 $6\frac{0}{4} = 4$ yds. $\qquad$ 1 $\quad$ 17 $\quad$ $0\frac{0}{4} = 8$ yds.

$$4 \qquad\qquad\qquad\qquad 6$$

3 $\quad$ 14 $\quad$ $0\frac{0}{4} = 16$ yds. $\qquad$ LI $\quad$ 2 $\quad$ $0\frac{0}{4} = 48$ yds.

$$6 \qquad\qquad\qquad\qquad 2$$

L 22 $\quad$ 4 $\quad$ $0\frac{0}{4} = 96$ yds. $\qquad$ L 22 $\quad$ 4 $\quad$ $0\frac{0}{4} = 96$ yds.

2. Calculate 16 yds. at 4s. $9\frac{1}{2}$d. - Anf. L 3 16 8.
3. ———— 18 yds. at 4s. $8\frac{1}{2}$d. - - Anf. L 4 4 9.
4. ———— 21 yds. at 5s. $4\frac{1}{4}$d. - Anf. L 5 12 $5\frac{1}{4}$.
5. ———— 22 yds. at 4s. $10\frac{1}{2}$d. - - Anf. L 5 7 3.
6. ———— 24 yds. at 5s. $4\frac{1}{4}$d. - - Anf. L 6 8 6.
7. ———— 28 yds. at 7s. $6\frac{1}{4}$d. - Anf. L 10 10 7.
8. ———— 32 yds. at 3s. 9d. - - - Anf. L 6.
9. ———— 33 yds. at 7s. $1\frac{1}{2}$d. - Anf. L 11 15 $1\frac{1}{2}$.
10. ———— 35 yds. at 1s. $11\frac{3}{4}$d. - Anf. L 3 9 $3\frac{1}{4}$.
11. ———— 36 yds. at 1s. 4d. - - Anf. L 2 8.
12. ———— 42 yds. at 7s. $6\frac{1}{2}$d. - Anf. L 15 16 9.
13. ———— 45 yds. at 3s. 3d. - - Anf. L 7 6 3.
14. ———— 48 yds. at 4s. $2\frac{1}{2}$d. - - Anf. L 10 2.
15. ———— 49 cwt. at L 2 7. 1. - Anf. L 115 7 1.
16. ———— 50 cwt. at L 4 3. - Anf.
17. ———— 54 cwt. at L 2 4. - Anf.
18. ———— 56 ftone at 11s. 6d. - Anf.
19. ———— 63 doz. at 9s. 6d. - Anf.

20. Calculate 64 yds. at 4s. 4d.   Anf.
21. ——— 66 yds. at 3s. 7½d.   - Anf.
22. ——— 72 lib. at 9s. 1½d.   - Anf.
23. ——— 84 lib. at 3s. 9½d.   - Anf.
24. ——— 88 lib. at 10s. 3¼d. - Anf.
25. ——— 96 lib. at 5s. 5½d.   - Anf.
26. ——— 108 cwt. at L 1 12.   - Anf.
27. ——— 132 cwt. at L 3 4 6.   Anf.
28. ——— 144 cwt. at L 5 17 6.   Anf.

RULE III.—When component parts cannot be obtained for the whole multiplier, multiply by those numbers whose product comes nearest to it; then by that number which makes up the compliment, and the sum of the products will be the answer.

EXAMPLES,

1. What is the price of 59 lib. of tea, at 5s. 3½d. per lib. ?

$$4 \quad 3\tfrac{1}{2} \times 3$$
$$7$$

$$\left. \begin{array}{ccc} 1 & 10 & 0\tfrac{1}{2} = 7 \\ & & 8 \\ \hline 12 & 0 & 4\tfrac{0}{4} = 56 \\ & 12 & 10\tfrac{1}{2} = 3 \\ \hline L\,12 & 13 & 2\tfrac{1}{2} = 59 \end{array} \right\} \text{lib.}$$

2. Calculate 29 lib. at 7s. 6d.   -   Anf. L 10 17 6.
3. ——— 31 lib. at 3s. 3¼d.   -   Anf. L 5 2 0½.
4. ——— 39 lib. at 4s. 9d.   -   Anf. L 9 14 3.
5. ——— 47 lib. at 5s. 3¼d.   -   Anf. L 12 7 8¾.
6. ——— 59 lib. at 5s. 11½d. -   Anf. L 17 11 6½.
7. Mult. 69 yds. 3 qrs. by 71. Anf. 4952 yds. 1 qr.
8. ——— 4 cwt. 3 qrs. 12 lib. by 79.

Anf. 383 cwt. 3 qrs. 24 lib.

9. ——— 16 lib. 1 oz. 13 grs. by 98.

Anf. 1576 lib. 4 oz. 13 dwt. 2 grs.

RULE IV.—When the multiplier is large, multiply continually by 10, till the value of 10, 100, 1000, &c. (according as the question requires) be obtained; then the value of 1, 10, 100, &c. multiplied by the remaining part of the multiplier fuccessively in its due order, will give the value of each part. Lastly, add the products, and their sum will be the answer.

EXAMPLES.

1. What is the price of 2144 ftones of hay, at $4\frac{3}{4}$d. per ftone?

$$4\frac{3}{4} \times 4$$
$$10$$
$$3 \quad 11\frac{1}{2} \times 4$$
$$10$$
$$1 \quad 19 \quad 7\frac{0}{4} \times 1$$
$$10$$

19	15	$10\frac{0}{4}$	=	1000
		2		
39	11	$8\frac{0}{4}$	=	2000
	1	$7\frac{0}{4}$	=	4
	15	$10\frac{0}{4}$	=	40
1	19	$7\frac{0}{4}$	=	100

} ftones.

Anf. L 42 8 $8\frac{0}{4}$ = 2144 }

2. Calculate the price of 3420 lib. tea, at 4s. 4d.
3. ————————— 4807 yds. at 1s $4\frac{1}{2}$d.
4. ————————— 9001 cwt. at L 1 2 4.
5. ————————— 9999 bolls, at 14s. 6d.
6. ————————— 99004 ftones, at 4s. $4\frac{1}{4}$d.

PRACTICAL QUESTIONS.

1. What is the price of 7 ftones of cheefe, at $7\frac{1}{2}$d. per lib. Tron weight? - - - - - Anf. L 3 10.

2. What is the price of 33 fcore of lambs, at L 7 7 7 per fcore? - - - - - - Anf. L 243 10 3.

3. What length of a road will 2 men make in 42 days, when they can finifh 3 poles, 2 yards, 2 feet, 4 inches a day? - - - - Anf. 3 fur. 27 p. $\frac{1}{2}$ yd. 2 feet.

4. Required the weight of 508 spindles of yarn, each weighing 1 lib. 3 oz. 8 drs. Anf. 5 cwt. 2 qrs. 3 lib. 2 oz.

5. Bought at the India-house 32 chests of tea, each weighing 3 qrs. 14 lib. at 4s. 3d. per lib. ; What did the price of the whole amount to ?   -   -   Anf. L 666 8.

6. If the standard weight of 1 guinea of gold be 5 dwt. 9 grs., What will be the weight of 2000 guineas ?

Anf. 44 lib. 9 oz. 10 dwt.

7. A farmer fold in one feafon 150 bolls of wheat, at 23s. ; 85 bolls of barley, at 18s. ; 240 bolls of oats, at 12s. ; and 1700 stones of hay, at 4½d. per stone.; Req. the amount of his fales ?   Anf. 475 bolls. L 424 17 6.

8. 57 British failors having captured one of the Manilla ships, and the prize money being equally divided among them, each received L 2496 13 7¼ ; Req. the value of the prize ?   -   -   -   Anf. L 142310 15 5¼.

9. Req. the weight of 13 cart loads of hay, each weighing 12 cwt. 3 qrs. 15 lib.? Anf. 167 cwt. 1 qr. 26 lib.

10. A legacy being equally shared by 49 relations, each received L 132 14 3¼ ? Req. the amount of the legacy ?   -   -   -   -   -   -   Anf. L 6502 19 3¼.

11. Bought 8 horses at L 17 10 each ; 9 cows at L 9 14 6 ; 5 oxen at L 10 12 6 ; 18 calves at L 2 15 ; 19 ewes at L 1 3 ; and 25 lambs at 14s. 9½d. each ; For how much money may I draw on my banker to pay the account ?   -   -   -   -   -   -   Anf. L 348 12 9½.

12. What fum will pay 342 day-labourers for 4 days, at 1s. 3½ per day ?   -   -   -   -   -   Anf. L 88 7.

13. A merchant bought 7 bales of cloth, each containing 4 parcels, each parcel 16 pieces, and each piece 75 yards, at 10¾d. per yard ; Req. the number of yards, and price of the whole ?   Anf. 33600 yds.   L 1505.

14. A certain kingdom contains 30 counties, each county 63 parishes, each parish 460 families, and each family 7 persons. Now, suppofing a tax of 5s. 3d. per head to be impofed, What would it amount to ?

Anf. L 159752 5.

15. What is the weight of 56 kitts of butter, each

weighing 2 ſtones, 11 lib. 8 oz.; likewiſe of the empty
kitts, at 3 lib. 9 oz. each? Anſ. { Butter, 152 ſt. 4 lib.
{ Kitts, 12 ſt. 7 lib. 8 oz.

16. A nobleman diſtributed a certain ſum of money
among 43 paupers; to each he gave 11s. 4½d.; Req.
the ſum? - - - - - - - - - Anſ. L 24 9 1½.

17. What is the price of 473 ſheep, at 19s. 3¾d. each?
Anſ. L 456 14 9¾.

18. What ſum will defray the weekly expence of 13
maſons, at 2s. 1d. per day; 4 bricklayers, at 1s. 11½d.;
8 barrowmen, at 1s. 4d.; and 4 wrights, at 1s. 9d.?
Anſ. L 16 11 6.

19. A gentleman's whole eſtate is laid out in 25 farms
of equal extent, each of which contains 154 acres, 3
roods, and all of them are let in tack at L 1 2 6 per acre;
Req. the amount of his rental? - Anſ. L 4352 6 10½.

20. What is the price of 17 pieces of linen, each con-
taining 36 yds. at 4s. 6d. per yard? Anſ. L 137 14.

COMPOUND DIVISION.

RULE I.—Begin with the higheſt denomination, and
work as directed in integers.

II.—Reduce the remainder to the next inferior deno-
mination, and add thereto the given number of that name
(if any). Divide this as before, and ſo on to the loweſt
denomination.

EXAMPLES.

1. Divide L 7744 15 6 by 5.

5)7744 15 6(1548 19 1⅕
27
—
24
—
44   Mentally.
4   5|7744 15 6
20   1548 19 1⅕.
—
)95
45
—
6
1

2. Divide L 8778 14 6 by 6. - Anf. L 1463 2 5.
3. —— 4734 yds. 3 n. by 7.   Anf. 676 y. 1 q. 1 n.
4. —— 6482 ac. 3 r. by 8.   Anf. 810 ac. 1 r. 15 f.
5. —— 4225 ch. 12 b. by 9. Anf. 469 ch. 8 b. 1 f. $3\frac{5}{9}$ p.
6. —— 7744 cwt. 3 qrs. by 10.
                      - Anf. 774 cwt. 1 qr. $25\frac{3}{5}$ lib.
7. —— 3772 m. 4 fur. by 11. Anf. 342 m. 7 f. $25\frac{5}{11}$ p.
8. —— 4711 guin. by 12.   Anf. 392 guin. 12s. 3d.

Note. The following examples may be done mentally, by dividing fucceffively by the component parts of the divifor.

1. Divide L 7190 19 by 14. - Anf.
2. —— L 9999 9 9 by 16. - Anf.
3. —— 7473 crowns by 18. - Anf.
4. —— 4744 guineas by 21. - Anf.
5. —— 3143 yards by 22. - Anf.
6. —— 4144 miles by 24 - Anf.
7. —— 3007 lib. Troy by 25.   Anf.
8. —— 1300 lib. Apoth. by 27.   Anf.
9. —— 1903 cwt. 2 qrs. by 28.   Anf.
10. —— 974 guin. 7s. by 32. - Anf.
11. —— 1347 dol. 2s. by 36. - Anf.
12. —— 1447 cwt. 1 qr. by 42.   Anf.
13. —— 1547 hhds. 20 gal. by 49. Anf.
14. —— 1647 bales, 12 ream by 56. Anf.
15. —— 1747 years, 4 mo. by 64. Anf.
16. —— 1847 yds. 3 qrs. by 96.   Anf.

PRACTICAL QUESTIONS.

1. At the expiry of a leafe of 25 years, the proprietor found that he had received in full of rent L 3640 12 6; Req. the yearly rent of the tenement? Anf. L 145 12 6.

2. A gentleman diftributed L 20 15 among fome poor people; Req. the number, when each got 5s. ? Anf. 83.

3. Suppofe a perfon in 10 years to fpend L 3480 12 6 of his own, and contract debts to the amount of L 1400; What is his expence per year, month, week, and day?

$$\text{Ans}\begin{cases} \text{L } 488 & 2 & 3 & \text{per year.}\\ 37 & 10 & 11\tfrac{1}{4}\tfrac{1}{13} & \text{per month.}\\ 9 & 7 & 8\tfrac{3}{4}\tfrac{4}{13} & \text{per week.}\\ 1 & 6 & 9\tfrac{3}{4}\tfrac{4}{13} & \text{per day.} \end{cases}$$

4. Bought 24 acres of land, at L 959 13; What did it cost me per acre? - - - Anf. L 39 19 8½.

5. Thirteen gentlemen are equally concerned in an adventure to Sierra Leona, by which they lofe L 9004 18; Req. the particular lofs of each? Anf. L 692 13 8¾.

6. An Eaft-India merchant who has been 18 years in trade has realized a fortune of L 40780 17 6; How much is that per year on an average? Anf. L 2265 12 1.

7. Bought 472 pieces of broad cloth, at L 5664 4 6; freight, carriage, &c. came to L 20 17 6; What muft I fell it at per piece to gain L 150 on the whole? Anf. L 12 7 3.

8. The planet Venus revolves round the fun in 224 days and 17 hours of our time; How many revolutions will fhe perform in 21 years, 195 days, and 19 hours of the fame time? - - - - - - - Anf. 35 rev.

9. Divide L 4728 14 9½ among 4 men, A, B, C, and D. Give A $\tfrac{1}{4}$, B $\tfrac{1}{5}$, C $\tfrac{1}{6}$, and D the remainder.

$$\text{Ans}\begin{cases} \text{L } 1182 & 3 & 8\tfrac{1}{4}\tfrac{3}{6} & \text{A.}\\ 945 & 14 & 11\tfrac{1}{2} & \text{B.}\\ 788 & 2 & 5\tfrac{1}{2}\tfrac{2}{6} & \text{C.}\\ 1812 & 13 & 8\tfrac{0}{4}\tfrac{0}{6} & \text{D.} \end{cases}$$

10. ——— L 1000 10 10 among 6 men, A, B, C, D, E, and F. Let A have the firft fhare, and each in fucceffion 2 guineas and 7d. more than the preceding one. Anf. A receives L 161 8 8½.

11. ——— L 3009 9 9 among 8 men and 5 boys, in fuch a manner that each man may have a fhare, and each boy $\tfrac{2}{7}$ of a fhare.

$$\text{Ans}\begin{cases} \text{L } 319 & 3 & 9\tfrac{0}{4}\tfrac{6}{11} & \text{each man.}\\ 91 & 3 & 11\tfrac{0}{4}\tfrac{2}{11} & \text{each boy.} \end{cases}$$

12. ——— L 108 15 6 among 4 men, 7 women, and 13 children, fo that each woman may have double the fhare of a child, and each man triple the fhare of a woman.

$$\text{Ans}\begin{cases} \text{L } 2 & 2 & 7\tfrac{1}{4}\tfrac{9}{11} & \text{child.}\\ 4 & 5 & 3\tfrac{3}{4}\tfrac{1}{11} & \text{woman.}\\ 12 & 15 & 11\tfrac{1}{4}\tfrac{3}{11} & \text{man.} \end{cases}$$

D

13. If the clothing and education of 121 charity boys amount to L 1512 10 annually; What is the expence of each? - - - - - - - - - - - Anf. L 12 10.

14. A father at his death left L 25000 to be divided among his 4 sons, Jack, Tom, Bill, and Harry, as follows, viz. for each shilling Harry receives Bill is to receive 2, Tom 4, and Jack 7; What sum does each receive?

$$\text{Anf.} \left\{ \begin{array}{l} \text{L } 1785 \ 14 \ 3\tfrac{1}{4}\tfrac{5}{7} \ \text{Harry.} \\ 3571 \ \ 8 \ 6\tfrac{1}{4}\tfrac{3}{7} \ \text{Bill.} \\ 7142 \ 17 \ 1\tfrac{1}{2}\tfrac{6}{7} \ \text{Tom.} \\ 12500 \ \ 0 \ 0\tfrac{0}{7} \ \text{Jack.} \end{array} \right.$$

PROPORTION.

PROPORTION is that rule by which the value, number, or quantity of one kind of things is proportioned to the value, number, or quantity of another kind of things, according to some fixed stipulation or known conclusion.

SIMPLE PROPORTION.

RULE I.—To ftate the Terms.

On the right hand set down that number which is of the same kind as the number required, which call the *term of comparifon*, and prefix four dots (thus : :); then take the two remaining terms, and having compared them with the term already set down, determine from the nature of the queftion whether the anfwer should be greater or less than the above mentioned term. If greater, set the greateft of the two in the second place, and the least in the third place, with two dots between them (thus :); but if less, the contrary.

II.—To work the Question, and find the Anfwer.

Diftinguish the terms by denominating the one on the left hand the *antecedent*, and the other the *confequent*; then the product of the *term of comparifon* and *confequent*

divided by the *antecedent*, will quote the fourth term or answer, and will always be of the same name with the term of comparison.

EXAMPLES.

1. If 4 cwt. of flax cost L 9; What will be the price of 32 cwt.?

$$
\begin{array}{ccc}
a. & c. & L. \\
4 : & 32 :: & 9 \\
 & 9 & \\
\hline
 & 288 &
\end{array}
\quad \text{Or thus abridged.}
\left\{
\begin{array}{ccc}
a. & c. & L. \\
4 : & 32 :: & 9 \\
\hline
1 : & 8 & \\
 & & 9
\end{array}
\right.
$$

Ans. L 72   Ans. L 72

2. If 32 cwt. cost L 72; What will 4 cwt. cost?

$$
\begin{array}{cccc}
a. & c. & L. & L. \\
32 : & 4 :: & 72 : & 9 \text{ Ans.}
\end{array}
$$

3. If L 9 be the price of 4 cwt. of flax; What quantity, at the same rate, may I have for L 72?

$$
\begin{array}{cccc}
a. & c. & cwt. & cwt. \\
9 : & 72 :: & 4 : & 32 \text{ Ans.}
\end{array}
$$

4. If for L 72 I have 32 cwt. of flax; What quantity, at the same rate, will I have for L 9?

$$
\begin{array}{cccc}
a. & c. & cwt. & cwt. \\
72 : & 9 :: & 32 : & 4 \text{ Ans.}
\end{array}
$$

Proof. Vary the question as in the four preceding examples, where each one proves another; or by multiplying the extremes and means, thus.

$$4 \times 27 = 9 \times 32 = 288.$$

Note. If any of the terms consist of different denominations, reduce them to the lowest; and let the *antecedent* and *consequent* always be of the same name.

5. If 8 yds. 3 qrs. of linen cost L 1 13; What will 48 yds. 2 qrs. cost?

$$
\begin{array}{ccc}
a. & c. & L. \text{ s.}
\end{array}
$$

Terms stated. $8\ 3 : 48\ 2 :: 1\ 13$

$$4420\quad L.\ s.\ d.$$

Terms reduced. $35 : 194 :: 33 : 9\ 2\ 10\frac{1}{4}\ \frac{11}{35}$ Ans.

D 2

6. If a staff that is $3\frac{1}{2}$ feet long, when placed perpendicular on a horizontal plane, have a shadow of 5 feet; How high is that steeple whose shadow is 580 feet?

a.   c.   feet.   feet.

$5 : 580 :: 3\frac{1}{2} : 406$ Anf.

7. Lent my friend on an emergency L 480 for 48 days; How long may I retain L 300 of his money to be indemnified? - - - - - - - Anf. $76\frac{4}{5}$ days.

8. A merchant bought a quantity of tea and sugar; the quantity of tea was 48 lib. and for every 3 lib. of tea he had 8 lib. of sugar; Req. the quantity of sugar?

Anf. 128 lib.

9. If a courier finish a journey in 27 days by travelling 8 hours per day; In how many days, at the same rate of travelling, will he finish the same journey when he travels 12 hours per day? - - - - - Anf. 18 days.

10. If an ounce of silver be worth 5s.; What is the value of a silver bowl that weighs 1 lib. 11 oz. 4 dwt.?

Anf. L 5 16.

11. There is a ciftern that holds 8000 ale gallons; it receives at one pipe 142 pints per hour, and difcharges at another pipe 10 pints in the fame time; In what time will it be filled?

a.   c.   h. d. h. m. fec.

$142 - 10 = 132 : 8000 \times 8 :: 1 : 20\ 4\ 50\ 54$ Anf.

12. A, flying at the rate of 95 miles in 2 days, is purfued on the morning of the 4th day by B, pofting 115 miles in the same time; In how many days, and after how many miles travel, will A be overtaken?

115

95   c.   days. days.

a. $20 : 142\frac{1}{2} :: 2 : 14\frac{1}{4}$ travelled by B.

miles. fur.

Then $\frac{115}{2} = 57\frac{1}{2} \times 14\frac{1}{4} = 819$ 3 dift. travelled by each.

13. A merchant bought 5 bales of Ofnaburgs, each containing 28 pieces, and each piece 75 yds. at the rate of 24s. for 18 yds.; What did the whole coft him?

Anf. L 700.

14. An architect computed that 8 men would build a wall in 40 days, but the proprietor would have it done in 10; How many men must he employ? - - Anf. 32.

15. If the penny loaf weigh 6 oz. when wheat is fold at 24s. per boll; What should it weigh when wheat is fold at 18s.? - - - - - - - - - - Anf. 8 oz.

16. If a garrison of 2000 men have provisions for 6 months; How many men will the same quantity serve 8 months? - - - - - - - - - Anf. 1500 men.

17. The whole valued rent of a parish is L 3003 3, and a rate of L 155 4 3 is granted to the poor; What fum muft A D pay whose valuation amounts to L 400 10?
$$\text{Anf. L 20 15 } 3\tfrac{3}{4}\tfrac{3645}{20001}.$$

18. If the longeft arm of the beam of a balance be 25 inches, and the shorteft only 20; What weight fuspended on the shorteft arm will equiponderate 24 lib. on the longeft? - - - - - - - - - - - Anf. 30 lib.

19. A traveller finishes a journey in 24 days by travelling 12 hours per day; In what time will he finish it when he travels 16 hours per day? - Anf. 18 days.

20. How many yards $3\tfrac{1}{4}$ qrs. wide are equal in square measure to 37 yds. $5\tfrac{1}{2}$ qrs. wide? - Anf. $58\tfrac{1}{7}$ yds.

21. If a carrier receives 35s. for the carriage of 49 cwt. 30 miles; What weight may he carry 24 miles for the same money? - - - - - Anf. 61 cwt. 1 qr.

22. If a carrier receives 35s. for the carriage of 49 cwt. 30 miles; What ought he to charge for the carriage of 61 cwt. 1 qr. the same diftance? - Anf. L 2 3 9.

23. Bought 335 ells English, at L 300; What muft I charge for 6 yds. of it to gain L 14 18 $8\tfrac{1}{2}$ on the whole?
Anf. L 4 10 3.

24. If 231 cubic inches make a wine gallon, and 282 an ale gallon; How many gallons of ale will fill a cafk that holds 60 gallons of wine? - - Anf. $49\tfrac{7}{47}$ gal.

25. If a pipe whose diameter is $9\tfrac{1}{2}$ inches empty a ciftern in 12 hours; In what time will another do it whose diameter is 6 inches? - - Anf. $30\tfrac{1}{12}$ hours.

26. If 32 yds. of linen are worth 6 yds. of broad cloth,

and 6 yds. of broad cloth worth 25 lib. of tea, and 25 lib. of tea worth 108 lib. of sugar, and 6 lib. of sugar worth 5s.; Req. the price of the 32 yds. linen? Ans. L 4 10.

27. A farmer having sold off his whole stocking, &c. finds that the value of his horses amounts to L 340; his cows to L 284; his oxen to L 210; his sheep to L 199; wheat L 314; barley L 215; oats L 200; and pease, &c. L 48: He is to lay the whole out on land which he has purchased at the rate of 2¼ acres for L 42 10; Req. the number of acres?   -   -   Ans. 95 ac. 3 r. 11 13/17 f.

COMPOUND PROPORTION.

RULE.—Place the term of *comparison* on the right, as in simple proportion, and dispose of each pair of like terms according to the directions there laid down; then will there be two or more *antecedents*, and as many *consequents*. Now the continued product of the term of comparison and consequents divided by the continued product of the antecedents, will quote the answer.

EXAMPLES.

1. If L 100 principal in 12 months gain L 5 interest; What will be the interest of L 840 for 8 months?

	a.	c.	a.	c.	L.
Stated.	12 : 8 :: 100 : 840 :: 5				
Abridged.	3 : 2 :: 5 : 42				

Here L 5 int. is the term of comparison.

$$\begin{array}{cc} 5 & 2 \\ \overline{15} & \overline{84} \\ & 5\ \text{L.} \end{array}$$

)420(28 Ans.

2. If L 28 be the interest of L 840 for 8 months; What will be the interest of L 100 for 12 months?

	a.	c.	a.	c.	L.	L.
	12 : 8 :: 840 : 100 :: 28 : 5 Ans.					

3. If 25 masons build a wall 36 feet long, 6 high, and 2 thick, in 18 days 12 hours long; How many masons must be employed to build another wall 144 feet long, 12 high, and 4 thick, in 10 days 15 hours long?

	a.	c.	a.	c.	a.	c.	a.	c.	a.	c.	maf.
Stated.	15 :	12 ::	10 :	18 ::	2 :	4 ::	6 :	12 ::	36 :	144 ::	25
Abr.	5 :	4 ::	5 :	9 ::	1 :	2 ::	3 :	6 ::	1 :	4	

$$5$$
$$\overline{25} \qquad\qquad\qquad \overline{16}$$
$$3 \qquad\qquad\qquad\qquad\quad 9$$
$$\overline{75} \qquad\qquad\qquad \overline{144}$$
$$2$$

Becaufe mafons is the number fought;   288
the given number of mafons (25) is the   6
term of comparifon. $\overline{1728}$
$$25$$
$$\overline{8640}$$
$$3456 \text{ maf.}$$
$$)43200(576$$

Note. The fame anfwer may be obtained by taking the
two folidities as one pair of terms, and their refpective
times as another pair, thus.

	a.	c.	a.	c.	maf.
Stated.	150 :	216 ::	432 :	6913 ::	25
Abridged.	25 :	36 ::	1 :	16	

$$36$$
$$\overline{96}$$
$$48$$

Anf. 576 mafons.

4. If 8 men dig 24 cubic yards of an earthen mound
in 6 days; How many men muft be employed to dig 36
cubic yards in 4 days? - - - - - Anf. 18 men.

5. If 18 men dig 36 cubic yds. in 4 days; How many
cubic yds. will 8 men dig in 6 days at the fame rate of
working? - - - - - - - - - -Anf. 24 cub. yds.

6. If the penny loaf weigh 8 oz. when wheat is fold
at 18s. per boll; What ought to be the weight of a loaf
worth 8d. when wheat is fold at 24s. per boll? Anf. 48 oz.

7. If the 8d. loaf weigh 48 oz. when wheat is fold at
24s. per boll; Req. the price of the wheat per boll when
the penny loaf weighs 8 oz.? - - Anf. 18s. per boll.

8. If 16 masons build 32 roods in 3 days; How many roods will 18 masons build in 15 days? Anf. 180 roods.

9. If 18 masons build 180 roods in 15 days; How many masons will build 32 roods in 3 days? Anf. 16 maf.

10. If 4 men cut down 12 acres of grafs in 6 days; How many acres will 16 men cut down in 15 days?
Anf. 120 acres.

11. If 16 men cut down 120 ac. of grafs in 15 days; How many ac. will 4 men cut in 6 days? Anf. 12 acres.

12. If 12 acres are cut down by 4 men in 6 days; How many men will cut down 120 ac. in 15 days? Anf. 16 men.

13. If 4 horfes eat 2 bolls of oats in 16 days; How long will 360 bolls ferve 120 horfes? - Anf. 96 days.

14. If 24 reapers in 6 days reap 48 acres of wheat; How many acres will 30 reapers reap in 18 days?
Anf. 180 acres.

15. If 24 reapers in 6 days reap 48 acres of wheat; How many reapers will reap 180 acres in 18 days?

16. If 24 reapers in 6 days reap 48 acres; In how many days will 30 reapers reap 180 acres?

17. If 30 reapers in 18 days reap 180 acres.; How many acres will 24 reapers reap in 6 days?

18. If 30 reapers in 18 days reap 180 acres; How many reapers will reap 48 acres in 6 days?

19. If 30 reapers in 18 days reap 180 acres; In how many days will 24 reapers reap 48 acres?

20. A folid foot of ftone was 16 inches broad, and 3 inches thick; Req. its length? - - Anf. 36 inches.

21. If 288 masons build a wall 180 feet long, 6 high, and 4 thick, in 3 days 10 hours long; In how many days 12 hours long, will 50 masons build another wall 40 feet long, 10 high, and 3 thick, at the fame rate of working? - - - - - - - - - - Anf. 4 days.

22. When money was at 4½ per cent. I lent my friend L 200 for 60 days; How long may I retain L 120 of his money to be indemnified when money is lent at 5. per cent.? - - - - - - - - - - Anf. 90 days.

23. If 4 men dig a trench 8¼ feet long, 3½ deep, and 2¼ broad in 9⅓ days; In what time will 8 men dig an-

other 25½ feet long, 7 broad, and 4½ deep, at the same rate of working? - - - - - - Ansſ. 56 days.

24. How long muſt L 340 be at intereſt to gain L 54 16, at 4½ per cent. per annum? Anſ. 3 y. 7 m. 15 d.

PROPORTION OF VULG. FRACTIONS.

RULE.—State the terms as in the preceding rule. Prepare the fractions according to the directions given in the reſpective rules, and multiply and divide accordingly.

EXAMPLES.

1. If $\frac{5}{8}$ of a yard coſt L 1¼; What will 8$\frac{4}{5}$ yds. be worth? a. c. L.

$$\frac{5}{8} : \frac{44}{5} :: \frac{7}{4} = \frac{308}{20} \left(\frac{2464}{100} \right. = \text{L} 24 \ 12 \ 9\frac{1}{5}\frac{2}{5} \text{ Anſ.}$$

2. If 8$\frac{4}{5}$ yds. coſt L 24 12 9$\frac{1}{5}\frac{2}{5}$; What will be the price of $\frac{5}{8}$ of a yard?

a. c. (L.

$$\frac{44}{5} : \frac{5}{8} :: \frac{118272}{4800} = \frac{591360}{38400} \left(\frac{2956800}{1689600} \right. = \text{L} 1 \ 15 \text{ Anſ.}$$

3. If 3 yds. coſt L $\frac{1}{9}$; What will be the price of 3 pieces, each containing 36$\frac{1}{3}$ yds.? - Ansſ. L 28 9 4.

4. If 109$\frac{4}{5}$ yds. coſt L 28 9 4; How many yds. will L $\frac{7}{9}$ buy? - - - - - - - - - Ansſ. 3 yards.

5. If I pay $\frac{4}{9}$ of a guinea for 4$\frac{2}{7}$ lib. of tea; What quantity, at the ſame rate, may I have for L 8$\frac{5}{8}$? Anſ. 44$\frac{1}{99}$ lib.

6. If I pay $\frac{4}{5}$ of $\frac{4}{7}$ of a guinea for the carriage of 2$\frac{3}{4}$ tons of goods 2$\frac{2}{3}$ miles; Req. the rate per ton each mile?

Anſ. 3¼d. $\frac{18}{77}$.

RULES OF PRACTICE.

TABLE OF ALIQUOT PARTS.

1d.	$=\frac{1}{12}$	⎫	3d.	$=\frac{1}{80}$	
1½d.	$=\frac{1}{8}$		4d.	$=\frac{1}{60}$	
2d.	$=\frac{1}{6}$	} of a ſhil.	6d.	$=\frac{1}{40}$	
3d.	$=\frac{1}{4}$		8d.	$=\frac{1}{30}$	
4d.	$=\frac{1}{3}$		1s.	$=\frac{1}{20}$	
6d.	$=\frac{1}{2}$	⎭	1s. 8d.	$=\frac{1}{12}$	
			2s.	$=\frac{1}{10}$	} of a pound.
56 lib.	$=\frac{1}{2}$	⎫	2s. 6d.	$=\frac{1}{8}$	
28 lib.	$=\frac{1}{4}$		3s. 4d.	$=\frac{1}{6}$	
16 lib.	$=\frac{1}{7}$	} of a cwt.	4s.	$=\frac{1}{5}$	
14 lib.	$=\frac{1}{8}$	⎭	5s.	$=\frac{1}{4}$	
			6s. 8d.	$=\frac{1}{3}$	
			10s.	$=\frac{1}{2}$	⎭

Case I.—When the price is any aliquot part of a pound, &c. contained in the table above, divide the given quantity by that part, and the quotient will be the answer, in the same name of which the price is a part.

EXAMPLES.

1. What is the price of 1748 yds. at 3s. 4d. per yd.?

s. d.   L.

$3\ 4 = \frac{1}{6} | 1748$

L 291 6 8

2. Cal. 471 yds. at 1d.	10. Cal. 717 yds. at 2s. 6d.
3. — 372 yds. at 2d.	11. — 815 yds. at 3s. 4d.
4. — 312 yds. at 3d.	12. — 457 yds. at 4s.
5. — 300 yds. at 4d.	13. — 336 yds. at 5s.
6. — 417 yds. at 6d.	14. — 883 yds. at 6s. 8d.
7. — 413 yds. at 1s.	15. — 942 yds. at 6s. 8d.
8. — 399 yds. at 1s. 8d.	16. — 999 yds. at 10s.
9. — 777 yds. at 2s.	17. — 904 yds. at 3s. 4d.

Proof. By compound multiplication.

Case II.—When the price is any even number of shillings, multiply the quantity by ½ the price. Double the right hand figure of the product for shillings; the rest will be pounds.

EXAMPLES.

1. Cal. 7443 yds. at 18s. 2. Cal. 8441 yds. at 16s.

9   8

Anf. L 6698 14   Anf. L 6752 16

Case III.—When the price is neither an aliquot part of a pound nor an even number of shillings, dispose it into aliquot parts, which work for severally, and the sum of the quotients will be the answer. If the quantity contains a fraction, take proportional parts of the price for it.

EXAMPLES.

1. Cal. 7434 yds. at 17s. 6d.

10	$=\frac{1}{2}$	7434
5	$=\frac{1}{2}$	3717
2 6	$=\frac{1}{2}$	1858 10
17 6		929 5

Ans. L 6504 15

2. Cal. 4342½ lib. at 15s.

10	$=\frac{1}{2}$	4343
5	$=\frac{1}{2}$	2171 10
		1085 15
7 6	$=\frac{1}{2}$ lb	

Ans. L 3257 12 6

3. Cal. 3427 yds. at 3s. 5d.
4. — 4143 yds. at 4s. 7½d.
5. — 1414 yds. at 5s. 11d.
6. — 917 yds. at 7s. 8½d.
7. — 479 yds. at 13s. 8½d.
8. Cal. 841 yds. at 14s. 6d.
9. — 741 yds. at 15s. 4d.
10. — 641 yds. at 17s. 10½d.
11. — 541½ yds. at 18s. 3d.
12. — 441¾ yds. at 19s. 6d.

CASE IV.—When the price consists of pounds, shillings, pence, &c. multiply the quantity by the number of pounds, and take parts for the shillings, &c. as in the former case.

EXAMPLES.

1. Calculate the price of 48 cwt. at L 3 12 6.

	48	
	3	
10 $=\frac{1}{2}$	144 at L 3	0 0
2 6 $=\frac{1}{4}$	24 at	1 0 0
	6 at	2 6

Ans. L 174 at L 3 12 6

2. Cal. 315 cwt. at L 2 11 6.
3. — 410 cwt. at L 2 17 3.
4. — 511 cwt. at L 4 2 6.
5. Cal. 777 ton at L 11 7 6.
6. — 314 cwt. at L 5 14 6.
7. — 841 ton at L 15 17 9.

CASE V.—When the given price is so near a pound, or any aliquot part thereof, that it cannot be disposed into aliquot parts, reduce the price to the lowest denomination it contains ; multiply the given quantity thereby, and reduce the product to pounds.

EXAMPLES.

1. Cal. the price of 18735 yds. muslin, at 9s. 11¾d. per yard.

$$119\tfrac{1}{4}$$

$$168615$$
$$18735$$
$$18735$$
$$468\tfrac{3}{4}$$

$$12)2234148\tfrac{3}{4}$$
$$2)186179\;\;0$$

Anf. L 9308 19 0¾

2. Cal. 417 yds. at 14s. 8¼d. | 5. Cal. 1111 yds. at 19s. 1½d.
3. — 571 yds. at 14s. 9¼d. | 6. — 721 yds. at 19s. 4¼d.
4. — 443 yds. at 28s. 11½d. | 7. — 888 yds. at 19s. 10¾d.

CASE VI.—When a troublesome fraction occurs in the price, multiply the integral part by the denominator, and to the product add the numerator. Work for this product as if it were the real price, but divide the answer so found by the same denominator by which you multiplied for the true answer.

EXAMPLES.

1. Cal. the price of 8841 yds. toweling, at 9⅘d. per yd.

$$3\;\;4=\tfrac{1}{6}|8841$$
$$8=\tfrac{1}{5}|1473\;\;10$$
$$1=\tfrac{1}{8}|\;\;294\;\;14$$
$$4\;\;1\qquad\;\;36\;\;16\;\;9$$
$$5)1805\;\;0\;\;9$$

Anf. L 361 0 1¼ ⅕

2. Cal. 7731 yds. at 10⅘d. || 7. Cal. 517 yds. at 1s. 2⅘d.
3. — 1472 yds. at 11³⁄₇d. || 8. — 663 yds. at 11s. ⅘d.
4. — 889 yds. at 1s. 1⅘d. || 9. — 907 yds. at 10⅚.
5. — 484 yds. at 1s. 2⅜d. || 10. — 999 yds. at 1s. 4¼d.
6. — 437 yds. at 1s. 3⅕d. || 11. — 904 yds. at 1s. 5¾d.

No. I.

Mr James Stark, Cooper,

                         Bot. of Arnot & Duff,

1798,   yds.

Aug. 31. 4 Ps. Scots linen══120, at 2s. 6d.

     3 Do. do. ══ 96, at 2s. 10d.

     7 Do. Irish do. ══188, at 2s. 4d.

   12 Do. lawns ══208, at 3s. 1d.

    9 Do. cheques ══170, at 1s. 1d.

   12 Do. linf. woolf.══240, at 1s. 4d.

                 Amot. L107 16 2

No. II.

Mr John Nicoll

                    Bot. of Robert Mitchel & Co.

98,

Aug. 31. 148 Pints double whiſky, at 4s. 6d.

    345 Do. ſingle do. at 2s. 1d. -

    708 Do. gin, at 3s. 2d. - - -

  1480 Do. coniac brandy, at 8s. 4d.

    907 Do. ſhrub, at 3s. 1½d. - -

    72 Do. Jamaica rum, at 7s. 7¾d.

    72 Barrels raiſins, at L 2 11 6.

            Anſ. L 1152 12 0$\frac{7}{10}$

No. III.

Mr Richard Gall, Edinr.

                    Bot. of James Dempſter, hoſier,

98,

Sep. 2. 148 Pairs mens ſilk ſtockings, at 8s. 6d.

   274 Do. womens do. at 6s. 4d. -

   156 Do. childrens do. at 5s. - -

   348 Do. mens worſted do. at 4s. 6d.

   397 Do. womens do. at 3s. 3d. -

   156 Do. childrens do. at 1s. 8d. -

   414 Do. mens thread do. at 4s. 2d.

   200 Do. womens do. at 3s. 9d. -

   156 Do. childrens do. at 1s. 6d. -

   400 Yds. velveret, at 4s. 6d. - -

    19 Yds. do. at 3s. 11d. - - -

    25 Yds. ſilk ſtriped ſtuffs, at 6s. 2d.

   135 Yds. druggets, at 2s. 4d. - -

   200 Reams poſt paper, at 20s. 6d.

       E   L 847 2 2

No. IV. *A wine merchant's bill.*

Mr Philip Gow, Edinr.

1799,   Bot. of Edward Pim,

Jan. 1. 16 Gallons palm sack, at 8s. 6d. L
         18 Do. red port, at 5s. 9d. - - -
         12 Do. claret, at 8s. 10d. - - -
         36 Do. white Lisbon, at 5s. - - -
         24 Do. Renish, at 6s. 6d. - - -
         28½ Do. sherry, at 6s. - - - -
          9 Do. Madeira, at 6s. 4d. - - -
         11¾ Do. Malago, at 8s. - - - -

                                   L 50 3 6

No. V. *A grocer's bill.*

Mrs Dorothy Drumsticks

99,   Bot. of Peter Pindar,

Jan. 4. 17½ Lib. bohea tea, at 4s. - - L
         12 Do. ditto, at 4s. 3d. - - -
         19¼ Do. congo do. at 4s. 2d. - - -
         12½ Do. green do. at 7s. 6d. - - -
         57 Do. coffee, at 2s. 6d. - - -
        142 Do. sugar, at 9¾d. - - - -
         14 Do. currants, at 8½d. - - -
         16 Do. raisins, at 8d. - - - -

                                   L 28 13 5

No. VI. *A milliner's bill.*

Miss Fashionable

99,   Bot. of Eliza Fancy,

May 3. 21 Yds. fine lace, at 12s. 3d. - L
        15 Pairs gloves, at 2s. 2d. - - -
        12 French fans, at 3s. 6d. - - -
         7 Laced tippets, at 4s. 1d. - - -
         5 Doz. pair lin. gloves, at 18s. 6d.
         8 Set of knots, at 2s. 6d. - - -
        13 Bonnets, at 14s. 6d. - - -
        15 Fur tippets, at 9s. 3d. - - -
         9 Straw bonnets, at 7s. 4d. - - -
        12 Muffs, at 14s. 6d. - - -

                                   L 52 0 1

Form of an houſehold account.

1798,		L.	s.	d.	L.	s.	d.
Aug. 1.	To caſh rec. from Mr Sheridan	48	7	8			
2.	By caſh pd. for beef - - -				1	17	6
	By do. pd. for mutton and veal					19	6
	By do. pd. for tea and ſugar -				1	3	7
6.	By do. pd. for 3 counterpanes				6	4	
7.	By do. pd. for coals - - -				3	10	6
12.	By do. pd. the ſhoemaker's ac.				29	14	6
17.	By do. pd. for wine - - -				8	3	1
25.	To do. rec. from Mr Sheridan	30	15	4			
31.	By do. pd. the baker's ac. -				19	10	3
Sep. 3.	By do. pd. for butcher meat -				3	8	6
5.	By do. pd. for 8 rummers -					12	
7.	By do. pd. for 8 ſtones cheeſe				4		
12.	By do. pd. for veal - - -				1	3	4
	L	79	3	0	80	6	9
					79	3	

Sep. 13. 98. Bal. due by Mr Sheridan - L 1 3 9

Form of an account in a merchant's ledger.

Mr John Paywell, Edinr. Dr. Cr.

98,		L.	s.	d.	L.	s.	d.
Aug. 3.	To 15 lib. tea, at 5s. - - -	3	15				
	To 12 lib. coffee, at 2s. 6d. -	1	10				
	To 10 ſtones cheeſe, at 8s. 6d.	4	5				
13.	To 6 pints whiſky, at 2s. 9d.		16	6			
14.	By caſh rec. to account - -					10	
21.	To 4 doz. oranges, at 1s. 2d.		4	8			
23.	To 9 pints gin, at 3s. 6d. -	1	11	6			
25.	To 10 lib. ſugar, at 1s. 1d. -		10	10			
27.	To 3 lib. currants, at 11d. -		2	9			
31.	By caſh rec. to account - -				2	7	6
Sep. 3.	To 12 doz. bottles, at 2s. 9d.	1	13				
7.	To 18 pints whiſky, at 2s. 10d.	2	11				
18.	By caſh rec. to account - -				1	1	
	L	17	0	3	13	8	6
		13	8	6			

Bal. due by Mr Paywell - L 3 11 9

1. In decimal fractions the unit is supposed to be divided into 10 equal parts; each of these into 10 other equal parts, and each of these again into 10 other equal parts; and so on *ad infinitum*.

2. A decimal fraction is expressed by writing only the numerator with a point prefixed to the left of it, the denominator being known always to consist of an unit with as many cyphers as the numerator has places. Thus $\frac{3}{10}$ is expressed by .3; $\frac{4}{100}$ by .04; $\frac{15}{1000}$ by .015; $\frac{1275}{10000}$ by .1275, &c.

3. In the decimal scale of notation the figure next to the point expresses so many 10th parts of the integer, the one in the second place so many 100th parts; and so of the rest, still decreasing the value in a tenfold proportion.

REDUCTION OF DECIMALS.

Prob. I.—To reduce a vulgar fraction to a decimal.

Rule I.—Annex cyphers to the numerator for a dividend, and divide by the denominator, and the quotient will be the decimal sought.

II.—If the denominator cannot be found in the numerator increased with one cypher, o must be the first decimal place.

EXAMPLES.

1. Red. $\frac{1}{8}$ to a decimal.   -   - $\frac{1000}{8}$===Ans. .125
2. ——— $\frac{3}{8}$ to a decimal.   - - - - Ans. .375
3. ——— $\frac{5}{8}$ to a decimal.   - - - - Ans. .625
4. ——— $\frac{1}{4}$ to a decimal.   - - - - - Ans. .25
5. ——— $\frac{5}{16}$ to a decimal.   - - - - Ans. .3125
6. ——— $\frac{7}{35}$ to a decimal.   - - - - - Ans. .2

When the same figure is repeated successively in the quotient, the decimal is called a repetend, and must be marked with a point above it for distinction.

EXAMPLES.

1. Red. $\frac{1}{3}$ to a decimal.   -   - $\frac{1000}{3}$===Ans. .3̇33
2. ——— $\frac{2}{3}$ to a decimal.   - - - - - Ans. .666̇
3. ——— $\frac{2}{9}$ to a decimal.   - - - - - Ans. .222̇

4. Red. $\frac{4}{9}$ to a decimal. - - - - - - Anſ. .444

5. —— $\frac{1}{24}$ to a decimal. - - - - Anſ. .0416

6. —— $\frac{3}{45}$ to a decimal. - - - - Anſ. .0666

When the ſame figures in the quotient recur after certain rotation, the decimal is called a circulate, and the firſt and laſt of the recurring figures muſt be marked with points above them.

EXAMPLES.

1. Red. $\frac{1}{7}$ to a decimal. $\frac{1000000}{7}$ = Anſ. .142857

2. —— $\frac{1}{11}$ to a decimal. - - - - - Anſ. .09

3. —— $\frac{3}{14}$ to a decimal. - - - Anſ. .2142857

4. —— $\frac{1}{84}$ to a decimal. - - - Anſ. .01190476

5. —— $\frac{4}{41}$ to a decimal. - - - - Anſ. .09756

6. —— $\frac{2}{85}$ to a decimal. Anſ. .02352941176470588 2

PROB. II.—_To reduce the inferior denominations of any given integer to the decimal of that integer._

RULE I.—Reduce the given denominations to the vulgar fraction of the integer required.

II.—Reduce as directed in Prob. I. Or when there are ſeveral denominations, begin at the loweſt, and reduce them in their due order till you arrive at the integer required.

EXAMPLES.

1. Red. 1s. 4½d. to the decimal of a pound ſterling.

96|0)660(.06875 Anſ.   4|20

   840   Or thus.   12|45

   720   2|0|1375

   480   Anſ. .06875

2. Red. 6½d. to the decimal of a pound. Anſ. .027083

3. —— 17s. 6¾d. to the dec. of a pound. Anſ. .878125

4. —— 19s. 8d. to the dec. of a guinea. Anſ. .936507

5. —— 4s. 6d. to the dec. of a crown. - Anſ. .9

E 3

6. Red. 7oz. 9dwt. 12grs. to the dec. of a lib. Troy.
Anf. .622916

7. —— 3 qrs. 14 lib. to the dec. of a cwt. Anf. .875

8. —— 2 qrs. 3 nails to the dec. of a yd. Anf. .6875

9. —— 5 fur. 21p. to the dec. of a mile. Anf. .690625

PROB. III.—*To find the value of a decimal in the known parts of the integer.*

CASE I.—When the decimal is finite.

RULE.—Multiply the given decimal by its equivalent in the next inferior denomination, and point off from the product as many figures to the right as the given decimal has places. Continue the operation till you have gone through all the subdivisions of the integer.

EXAMPLES.

1. Req. the value of .21875 parts of a pound sterling?

$$20$$
$$\overline{4.37500}$$
$$12$$
$$\overline{4.50000}$$
$$4$$
$$\overline{2.00000}$$

Anf. 4s. $4\frac{1}{2}$d.

2. Value .0975 of a pound sterling. Anf. 1s. $11\frac{1}{4}$d.

3. —— .4735 of a pound sterling. - Anf. 9s. $5\frac{1}{2}$d.

4. —— .875 of a cwt. - - - Anf. 3 qrs. 14 lib.

5. —— .7475 of a lib. Troy. Anf. 8oz. 19dwt. 9grs.

6. —— .6875 of a yard. - - - Anf. 2 qrs. 3 nails.

7. —— .99375 of a ton. Anf. 19cwt. 3 qrs. 14 lib.

8. —— .25 of a guinea. - - - - Anf. 5s. 3d.

9. —— .875 of an acre. - - Anf. 3 roods, 20 falls.

CASE II.—When the decimal terminates in a repetend.

RULE.—Carry at 9 in the product of the repetend, and when a cypher occurs on the right of the multiplier, annex the repetend for it.

EXAMPLES.

1. Value .4302083
          20
   ———————
   8.6041666   Anf. 8s. 7¼d.
          12
   ———————
   7.2500000
          4
   ———————
   1.0000000

2. Value .173 of a pound fterling.   -   Anf. 3s. 5½d.
3. ——— .883 of an acre.   -   Anf. 3 r. 13 f. 12 ells.
4. ——— .5813 of a chalder. Anf. 9 bolls, 1 fir. 3 lip.
5. ——— .1713 of a cwt.   - - - -   Anf. 19 lib.
6. ——— .19946 of a guinea.   - -   Anf. 4s. 2¼d.

CASE III.—When the decimal terminates in a circle.

RULE.—To the product of the laft figure of the circle add the 10's in the product of the firft figure of the circle into the fame multiplier; then multiply in the common way till the whole value be obtained.

EXAMPLES.

1. Required the value of .6696428571 of a cwt.?

                                    4
                         ———————————
                         2.6785714285
   Anf. 2 qrs. 19 lib.   28
                         ———————————
                          54285714286
                          135714285714
                         ———————————
                          19.0000000000

2. Value .920634 of a guinea.   - -   Anf. 19s. 4d.
3. ——— .910714285 of a cwt.   -   Anf. 3 qrs. 18 lib.
4. ——— .982142857 of a cwt.   -   Anf. 3 qrs. 26 lib.
5. ——— .295634920 of a hhd.   Anf. 18 gal. 5 pints.
6. ——— .79938271604 of a moidore. Anf. 21s. 7d.

BY INSPECTION.

RULE.—Double the figure next to the point; and if the next figure be 5 or above, add 1 thereto for shillings, then the figure in the second place if below 5, or its surplus above 5 with the figure in the third place, make so many farthings; and for every 25 in the sum 1 must be deducted, and the remainder will be the answer in pence and farthings.

EXAMPLES.

1. Value .8995 of a L by inspection. Anf. 17s. 11¾d.
2. ——— .975 of a L. - - - - - Anf. 19s. 6d.
3. ——— .745 of a L. - - - - - Anf. 14s. 11d.
4. ——— .715 of a L. - - - - - Anf. 14s. 3¼d.
5. ——— .075 of a L. - - - - - - Anf. 1s. 6d.
6. ——— .009 of a L. - - - - - Anf. 2¼d.

To reduce shillings, pence, and farthings to the decimal of a pound sterling by inspection.

RULE.—Take half the number of shillings for the first decimal place; then the number of farthings in the remainder increased by 1 if it amounts to 24 or upwards; by 2 if to 48 or upwards; and by 3 if to 72 or upwards; will be the two next decimal places.

EXAMPLES.

1. Red. 14s. 8¼d. to the decimal of a L. Anf. .734
2. ——— 15s. 7½d. to the decimal of a L. Anf. .781
3. ——— 19s. 9¼d. to the decimal of a L. Anf. .988
4. ——— 3s. 5¾d. to the decimal of a L. Anf. .174

ADDITION OF DECIMALS.

RULE.—Arrange the given numbers by placing the decimal points exactly under each other; then on the left will be integers, and on the right decimals; and when all the decimals are finite, add as in integers, and let the decimal point in the sum range with those above.

Ex. (1.) 74.825   (2.) Red. and add as under.

```
         9.45      L 741  15  6==L 741.775
          .38135     375  13  3==   375.6625
        4.000725      94  12  9==    94.6375
       14.15           4  13  6==     4.675
        1.05           0   9  6==      .475
         .0713475     54   1  6==     54.075
     _____    _____   _____
     103.9284225  L 1271   6  0==L 1271.3 . . .
```

CASE II.—When all or any of the given decimals repeat.

RULE.—Give all the repetends the same number of places, and 1 more than the largeft finite. Carry at 9 in the right hand column; but in all the reft carry at 10.

Ex. (1.) 73.333333   (2.) L 14 13   4==L 14.66666
         84.675   17   6   8==   17.33333
         34.166666   9   3   4==   9.16666
         89.733333   74 19 11==   74.99583
         94.381416   13 13   8==   13.68333
      _____   _____   _____
        376.28975 .

CASE III.—When all or any of the decimals terminate in a circle.

RULE.—Make all the circles fimilar and conterminous; find the number of tens in the firft column of the circle, which add with the right hand column; then proceed as in finite decimals, only carry at 9 in the right hand column.

Note. Diffimilar circles may be made fimilar by finding the leaft common multiple of the number of places in the given circles, and extending each circle to as many places as the multiple contains units.

EXAMPLE.

```
  .74   ⎫                .747474   ⎫   Made fimilar; 6
  .354  ⎪                .354354   ⎪   being the leaft
  .59   ⎬ Diffimilar.    .595959   ⎬   common multi-
  .38   ⎪                .383838   ⎪   ple of 2 and 3.
  .914  ⎭                .914914   ⎭
                        _____
                        2.996544
```

Reduce and add cwt. qrs. lib.

$$
\begin{array}{rrll}
4 & 3 & 18 = & 4.91071428\dot{5} \\
9 & 3 & 26 = & 9.98214285\dot{7} \\
31 & 2 & 18 = & 31.66071428\dot{5} \\
3 & 3 & 10 = & 3.83928571\dot{4} \\
7 & 2 & 26 = & 7.73214285\dot{7} \\
\hline
\text{Cwt. } 58 & 0 & 14 = & 58.125\ldots\ldots
\end{array}
$$

SUBTRACTION OF DECIMALS.

Rule.—Arrange the factors as in addition; and when both are finite, subtract as in integers.

EXAMPLES.

$$
\begin{array}{ll}
(1.) \quad 741.843275 & (2.) \quad 78.000000075 \\
 341.9454125 & 9.12345 \\
\hline
 399.8978625 & 68.876550075
\end{array}
$$

Reduce and subtract as under.

$$
\begin{array}{lll}
\text{L}175\ 15\ 0 = \text{L}175.75 & \text{L}447\ 13\ 6 = \text{L}447. \\
\phantom{\text{L}}89\ 17\ 6 = \phantom{\text{L}1}89.875 & \phantom{\text{L}}329\ 14\ 9 = \phantom{\text{L}1}329. \\
\hline
\text{Anf. L}85\ 17\ 6 = \phantom{\text{L}1}85.875 & \text{Anf. L}117\ 18\ 9
\end{array}
$$

Case II.—If both, or only one of the factors repeat.

Rule.—Make the repetends conterminous in the firſt inſtance, and extend the repeating factor one place farther than the finite one in the second. In both caſes borrow at 9 in the right; but no where elſe.

EXAMPLES.

$$
\begin{array}{ll}
(1.) \quad 96.4378\dot{3} & (2.) \quad 71.738\dot{5} \\
 14.7121\dot{6} & 34.9478\dot{3} \\
\hline
\text{Anf. } 81.7256\dot{6} & \text{Anf. } 36.7906\dot{6}
\end{array}
$$

Reduce and subtract as under.

$$
\begin{array}{ll}
\text{L}\ 775\ 13\ 4 = \text{L}\ 775.66\dot{6} \\
\phantom{\text{L}\ }427\ 15\ 8 = \phantom{\text{L}\ }427.78\dot{3} \\
\hline
\text{L}\ 347\ 17\ 8 = \text{L}\ 347.88\dot{3}
\end{array}
$$

CASE III.—When either, or both factors terminate in a circle, prepare them as in addition; and if the figure in the left hand column of the circle in the subtrahend be greater than the figure in the same place in the minuend, add 1 to the right hand figure of the subtrahend, before subtraction.

EXAMPLES.

Dissimilar.	Made similar.
(1.) 897.45̈	897.4̇5454̇5
547.5̇62̇	547.56̇2562̇
	Ans. 349.891982

(2.) $348\frac{4}{13} = 348.\dot{3}0769\dot{2}$
$219\frac{9}{11} = 219.\dot{8}1818\dot{1}$
Ans. 128.489510

MULTIPLICATION OF DECIMALS.

RULE I.—When the decimals are finite, find the product as in integers, and from the right point off as many places as are in both factors. If the product has not so many figures, prefix cyphers on the left, to make up the complement.

EXAMPLES.

(1.) 74.3475	(2.) 314.2865
30.25	.00235
3717375	15714325
1486950	9428595
2230425	6285730
2249.011875	.738573275

RULE II.—If one of the factors be finite, and the other repeat, multiply by the finite factor, and carry at 9 in the right hand column; make the products conterminous, and in adding carry at 9 on the right. If the multiplier has cyphers on the right, continue the repetend for them in the product.

EXAMPLES.

(1.) 9746.53̇
     8.075
    ─────
    4873266
   68225733
  7797226666
  ─────────
  78703.25666

(2.) 3125.156̇
       .00015̇
     ─────
    15625783
   31251566̇
   ─────────
   .4687735·

RULE III.—When one of the factors is finite, and the other a circulate, multiply by the finite, and for each 10 in the product of the left hand figure of the circle add 1 to the product of the right hand figure of the circle by every multiplier; then multiply as in finite decimals, and prepare and add according to the rule given in addition of circulates.

EXAMPLES.

(1.)   3.42167̇
        53.05
       ─────
       1710837
     102650226
     1710837108
     ─────────
     181.5198174

(2.)   4.35642̇
         .00045
        ─────
        2178212
       17425702
       ─────────
       .0019603915

RULE IV.—When both factors repeat, reduce the repetend in the multiplier to a vulgar fraction, and take proportional parts of the multiplicand for it, after multiplying by the finite part as in Rule II.

EXAMPLES.

Mul. 874.316̇ by 74.83̇
        74.8⅓
       ─────
       6994533
      34972666̇
      612021666
         291438═⅓
      ─────────
      65428.0305

          874.316̇
           74⅚
          ─────
         34972666·
        612021666̇
         7285972═⅚
         ─────────
Or thus. 65428.0305

RULE I.—When both factors are finite, proceed as in integers, and point off so many places for decimals in the *quotient*, as with those in the divisor, may exactly equal the number of decimal places in the dividend.

EXAMPLES.

(1.) 7.55)874.5(115.827   (2.)6.75)842.5(124.814

$\qquad$ 1195 $\qquad$ (3.) $\quad$ 345)99.74(.2891

$\qquad$ 4400 $\qquad$ (4.) .1234)7.472(60.551

$\qquad$ 6250 $\qquad$ (5.) $\quad$ .005)9.975(1995.

$\qquad$ 2100

$\qquad$ 5900

$\qquad$ 615

RULE II.—When the divisor is finite, and the dividend repeats, divide as before; but after the dividend is exhausted, the division may be continued at pleasure, by annexing the repeating figure to the remainder.

EXAMPLES.   Quotients.

(1.) 4.5)99.16(22.037   (2.) 75.3÷1.5=50.2

$\qquad$ 91 $\qquad$ (3.) 9.16÷2.5= 3.6

$\qquad$ 166 $\qquad$ (4.) 9.93÷9.8=1.0136

$\qquad$ 316 $\qquad$ (5.) 84.6÷.05=1693.3

$\qquad$ 1

RULE III.—When the divisor is finite, and the dividend a circulate, the division may be continued to any length by dividing as usual, and annexing the figures in the circle successively to the remainder.

EXAMPLES.

(1.) 13.85)94.736(6.84019 (2.) .495÷2.5=.198

$\qquad$ 11636 $\qquad$ (3.) .741÷9.75=.076

$\qquad$ 5567 $\qquad$ (4.) .89÷4.5=

$\qquad$ 2736 $\qquad$ (5.) .127÷.94=

$\qquad$ 13517

$\qquad$ 1052

F

RULE IV.—When the divisor repeats, multiply both divisor and dividend by some digit that will exterminate the repetend in the divisor.

EXAMPLES.   **Answers.**

(1.) 4.83)74.151(
    3   3
14.5)222.453(15.34158
    774
    495
    603
    230
    850
    1250
    90

(2.) 47.8 : 1.16 = 40.97

(3.) 475 ÷ 2.16 = 217.69

(4.) 999 ÷ 3.13 = 318.82

(5.) 91.74 ÷ 3.3 = 27.522

(6.) 148.5 ÷ 1.24 = 119.33

(7.) 473.5 ÷ 7.3 = 64.5681

APPLICATION OF DECIMALS.

EXAMPLES.

1. How many square feet are contained in a floor whose length is 25 feet 8 inches, and breadth 18 feet 6 inches?

    25.6   25.6
    18.5   18½
    1283   Or thus.   20533
    20533   25666
    25666   1283

Anf. 474.83 = 474 f. 10 in. Anf. 474.83 the same.

2. There is a piece of mahogany 16 feet 8 inches long, 5 feet 3 inches broad, and 4 feet 4 inches thick; Req. its folidity and price, at 9d. per foot?

Anf. 379.16 fol.—Price L. 14 4 4½.

3. Req. the folidity of a block of marble whose dimenfions are 6 feet 8 inches, 5 feet 9 inches, and 4 feet 2 inches? - - - - - - Anf. 159.72 cub. feet.

4. There is a box 5 feet 9 inches long, 4 feet 4 inches wide, and 3 feet 9 inches deep; Req. its tonnage and freight, at L 2 7 6 per ton? - - Anf. L 5 10 11¼.

5. A lady fettled L 40 per annum on 4 poor widows, G, P, D, and H; directing G to draw ⅓, P ¼, D ⅕, and H ⅙. What fum did each draw?

$\frac{1}{3}$ = .333

$\frac{1}{4}$ = .25

$\frac{1}{5}$ = .2

$\frac{1}{6}$ = .166 $\frac{1}{3}$ $\frac{1}{4}$ $\frac{1}{5}$ $\frac{1}{6}$

.95) 40. (42.105263

14.035087 = L 14 0 8¼ G.

10.526315 =   10 10 6   P.

8.421052 =   8 8 5¼ D.

7.017543 =   7 0 4¼ H.

Proof L 40 . . . .   L 40 0 0¾ proof.

6. A ciftern that has 12 unequal cocks can be emptied by the firft in an hour; by the fecond in 2 hours; and fo on to the laft, which will empty it in 12 hours; In what time will it be emptied if all run together?

Anf. 19 min. 19 fec.

PROPORTION APPLIED TO PARTNERSHIP.

CASE I.—When each partner is concerned only to a certain extent.

RULE.—As the total ftock : each partner's particular ftock, : : the total dividend : each partner's fhare.

EXAMPLES.

1. Three partners, A, B, C, trade in company. A's ftock was L 400; B's L 600; and C's L 200. They have a dividend of L 527 profit; What fum muft each draw?

F 2

A L 400
B   600
C   200

1200 : 400 :: 527 : 175.66 A.
      : 600 :: 527 : 263.5   B.
      : 200 :: 527 :   87.83 C.
                L 527... proof.

2. Four partners, D, E, F, G, trade in company. D advances L 500; E L 800; F L 900; and G L 1200. They gain L 780; What sum does each draw?

3. 500 Acres of waste land is to be divided among 4 gentlemen, H, I, K, L, in proportion to their valuations. H's valued rent is L 400; I's L 350; K's L 1280; and L's L 710; How many acres will each receive?

4. A ship and cargo worth L 30000 being entirely lost at sea, of which $\frac{1}{3}$ belonged to M, $\frac{1}{4}$ to N, $\frac{1}{5}$ to O, and the rest to P; What loss will each sustain supposing L 1650 to be recovered by insurance?

5. Four partners, A, B, C, and D, purchase a sugarwork, of which A paid $\frac{3}{8}$, B $\frac{3}{7}$, C $\frac{2}{9}$, and D paid L 205 12; What was D's share; what did the work cost; and what did A, B, and C each contribute towards the purchase?

CASE II.—When the times of the partners capitals in trade are unequal.

RULE.—As the sum of the products of the capitals into their respective times : each particular product, :: the whole dividend : each partner's share of the dividend.

EXAMPLES.

1. A's capital of L 450 was 4 months in trade; B's of L 170 was 8 months; and C's of L 800 was 5 months. They gain L 533 14 6; What sum is each partner entitled to draw?

A L 450 × 4 = 1800
B   170 × 8 = 1360
C   800 × 5 = 4000

L.

7160 : 1800 :: 533.725 : 134.1766 A.
     : 1360 :: 533.725 : 101.3779 B.
     : 4000 :: 533.725 : 298.1703 C.

Proof L 533.725.

2. Four partners, A, B, C, and D, trade in co. A's capital of L 800 was in trade 9 months; B's of L 800 was 11 months; C's of L 500 was 4 months; and D's of L 300 was 12 months. They gain L 1000; What falls to the share of each?

3. A on the 1st of Jan. put into company L 1200; B could advance nothing till 1st June; What sum must he then advance to entitle him to an equal share of the profits at the year's end?

As 7 : 12 :: 1200 : L 2057 2 10¼ Ans.

4. Two partners, A and B, enter into partnership for 21 months. A puts in L 500, and at the end of 9 months puts in L 200 more, and at the end of 17 months puts in L 50 more; B puts in L 1500, and at the end of 7 months takes out L 1000, and at the end of 13 months puts in L 900. Their profits amount to L 630 12 4; What sum does each receive at the settlement?

5. A undertakes to finish a piece of work in 40 days, for L 5 15; but finding the task too heavy, agrees with B after 28 days labour to work along with him, for which he was to be paid proportionally; What did B receive?

Ans. L 1 6 6¼.

PROPORTION APPLIED TO PROFIT AND LOSS.

CASE I.—The prime cost and profit or loss upon it given, to find the gain or loss per cent.

RULE.—As the prime cost : the profit or loss, : : L 100 : the rate per cent.

EXAMPLES.

1. Bought cloth at 12s. and sold it at 14s.; What did I gain per cent.?

F 3

a. c.
As 12 : 2 :: 100 : $16\frac{2}{3}$ per cent. Anf.

2. Bought fugar at L 3 15 per cwt. and fold it at L 4 2; What did I gain per cent.? - - Anf. $9\frac{1}{3}$ per cent.

3. Bot. a filver watch at 6 guineas, and fold it at L 6; What did I lofe per cent.? - - Anf. $4\frac{16}{21}$ per cent.

CASE II.—When a certain rate per cent. is propofed to be gained or loft.

RULE.—As 100 : 100 with the rate per cent. added in cafe of gain, and deducted in cafe of lofs, : : the prime coft : the felling price.

EXAMPLES.

1. Bought cloth at 8s. upon which I would have 16 per cent. profit; What muft I fell it at?

a. c. s. s. d.
As 100 : 116 : 8 : 9 $3\frac{1}{4}$ $\frac{11}{23}$ Anf.

2. Bot. a horfe at L 15; What muft I fell him at to gain 30 per cent.? - - - - - - Anf. L 19 10.

3. Bot. a quantity of yarn at 3s. 4d. per fpindle; but getting it damaged, I am willing to lofe 6 per cent.; What muft I charge per fpindle? - Anf. 3s. $1\frac{1}{4}$d. $\frac{1}{23}$.

CASE III.—When the felling price and rate per cent. profit or lofs are given, to find the prime coft.

RULE.—As 100 with the rate added or deducted : 100 : : the felling price : the prime coft.

EXAMPLES.

1. Sold cloth at 15s. per yd. upon which I had 20 per cent. profit; What was the prime coft?

a. c. s. s. d.
$100 + 20 = 120$: 100 : : 15 : 12 6 Anf.

2. Sold cloth at 18s. per yd. on which I had $13\frac{1}{4}$ per cent. profit; What did I buy it at? Anf. 15s. $10\frac{3}{4}$d.

3. Sold cloth at 7s. by which I loft 4 per cent.; What did I buy it at? - - - - - - - Anf. 7s. $3\frac{1}{2}$d.

4. Sold a piano-forte at 22 guineas, by which I loft 12 per cent. whereas in the courfe of trade I fhould have gained 20 per cent.; How much was it fold under value?
Anf. 8 guineas.

CASE IV.—To find a proportional rate on *one* advanced price by having *another*, and the rate on it given.

RULE.—As the price whofe rate per cent. is given : the price whofe rate per cent. is required, : : 100 with the given rate added in cafe of gain, or deducted in cafe of lofs, : 100 added to the required rate in the firft inftance, and to 100— the required rate in the fecond.

EXAMPLES.

1. Sold cloth at 5s. per yd. upon which I had $12\frac{1}{2}$ per cent. profit; but markets rifing, I fold what remained at 6s. ; What did I clear per cent. by my laft fales?

a. c. -

As 5 : 6 :: 112.5 : 135—100=35 per cent. Anf.

2. Sold flax-feed at 18d. per lip. on which I had 30 per cent. profit ; but the market taking an unfavourable turn, I fold what remained at 14d. ; What had I per cent. on my laft fales? - - Anf. $1\frac{1}{9}$ per cent. profit.

3. Sold goods at 10s. per yd. on which I loft 2 per cent. I fold the fame goods afterwards at 12s. ; What per cent. had I then? - - Anf. $17\frac{1}{3}$ per cent. profit.

4. Sold yarn at 40d. per fpindle, on which I had 5 per cent. profit. I fold the fame afterwards at 32d. ; What per cent. was loft or gained on the laft fales?

Anf. 16 per cent. loft.

PROPORTION APPLIED TO BARTER.

RULE.—Firft write down the given quantity, and by a comparifon of the two prices, arrange the terms as is taught in the rule of proportion.

EXAMPLES.

1. How many hats, at 18s. each, may I have in barter for 423 yds. linen, at 4s. per yd. ?

a. c. yds. hats. Or thus, decimally. hats.

18 : 4 :: 423 : 94 Anf. 423 × .2 ÷ .9 = 94 Anf.

2. How many pieces of filk, at L 3 15, may I have in barter for 25 cwt. 3 qrs. of Riga flax, at L 2 5 per cwt. ? - - - - - - - - - - - - Anf. $15\frac{9}{10}$ pieces.

3. How many pairs of shoes, at 5s. 3d. may I have in barter for 756 yds. of cheque, at 1s. 4d. per yard?

Anf. 192 pairs.

4. What quantity of nutmegs, at L 5 12 per cwt. may be given in barter for 75 cwt. 3 qrs. 12 lib. tobacco, at 1s. 3d. per lib.? - - - - - - Anf. 32.321 cwt.

5. How many bolls of wheat, at 21s. may be given in barter along with L 20 for 8800 ftones hay, at 4d. per ftone? - - - - Anf. 126 bolls, 2 fir. 2$\frac{10}{83}$ pecks.

6. X receives from R 380 yds. linen at 5s. and gives him 96 lib. tea at 4s. 6d. and a certain quantity of raifins at 8d. per lib.; Req. the quantity of raifins?

Anf. 2202 lib.

TARE AND TRETT.

1. *Grofs weight* is the weight both of the commodity and package, fuch as cafk, bag, box, &c.

2. *Tare* is an allowance on weighable goods made at the cuftomhoufe to the importer, and by the feller to the buyer, for the outfide package above mentioned.

3. *Trett* is an allowance of 4 lib. per 104 lib. certain, granted for break, wafte, &c. on fuch goods as are fold by the lib. weight.

4. *Clough* or *Cloff*, is an allowance of 2 lib. on every 3 cwt. after tare and trett are deducted, to turn the fcale when goods are re-weighed.

5. *Suttle weight* is what remains after the tare is deducted from the grofs.

6. *Nett weight* is what remains after all the propofed allowances are made.

CASE I.—When the tare is inferted in the invoice along with the grofs weight.

RULE.—Subtract the tare from the grofs, and the remainder will be the nett weight.

EXAMPLES.

1. What is the nett of 4 hhds. tobacco; contents of grofs and tare as under?

	Grofs.				Tare.		
	cwt.	qrs.	lib.		cwt.	qrs.	lib.
No. 1.	15	3	14	=	0	3	25
2.	17	3	18	=	1	0	1
3.	14	1	19	=	0	2	10
4.	18	3	26	=	1	0	16
Total grofs	67	0	21		3	2	24
Total tare	3	2	24				

Anf. 63 1 25 nett weight.

2. What is the nett of 25 bags cotton yarn, each weighing 2 cwt. 3 qrs. 14 lib. grofs; tare 9 lib. per bag?

Anf. 69 cwt. 3 qrs. 13 lib.

CASE II.—When the tare is at a certain rate per cwt.

RULE.—Take aliquot parts for the tare; which fubtract from the grofs, and the remainder will be the nett weight.

EXAMPLES.

1. What is the nett of 412 cwt. 3 qrs. 14 lib. grofs; tare 18 lib. per cwt.?

$$16 \text{ lib.} = \tfrac{1}{7} \quad | \quad 412 \quad 3 \quad 14$$
$$2 \text{ lib.} = \tfrac{1}{8} \quad | \quad 58 \quad 3 \quad 26$$
$$| \quad 7 \quad 1 \quad 13\tfrac{3}{4}$$
$$66 \quad 1 \quad 11\tfrac{3}{4} \text{ tare.}$$

Anf. cwt. 346 2 2$\frac{1}{4}$ nett weight.

2. What is the nett of 456 cwt. 1 qr. 14 lib. grofs; tare 17 lib. per cwt.? - - - Anf. 387 cwt. 11$\frac{3}{4}$ lib.

3. Req. the nett and price of 8 hhds. tobacco, each weighing 2 cwt. 3 qrs. 4 lib. grofs; tare 15 lib. per cwt. and price L 2 7 6 per cwt.?

Anf. 19$\frac{1}{2}$ cwt. nett=L 46 6 3.

CASE III.—When there is an allowance both of tare and trett.

RULE.—Deduct the tare from the grofs as in the foregoing rule, and divide the remainder or futtle by 26, for the trett; which being deducted from the futtle, leaves the nett weight required.

EXAMPLE.

Req. the nett of 318 cwt. 2 qrs. 18 lib. groſs; tare 16 lib. per cwt. and trett 4 lib. per 104 lib.?

$$16 \text{ lib.} = \tfrac{1}{7} \,|\, 318 \quad 2 \quad 18 \quad \text{groſs.}$$

$$45 \quad 2 \quad 2\tfrac{4}{7} \quad \text{tare.}$$

$$26)\overline{273 \quad 0 \quad 15\tfrac{3}{7}} \quad \text{ſuttle.}$$

$$10 \quad 2 \quad 0\tfrac{4}{7} \quad \text{trett.}$$

Anſ. $262 \quad 2 \quad 14\tfrac{6}{7}$ nett.

CASE IV.—When tare, trett, and cloff are all allowed.

RULE.—Deduct the tare and trett as in the former Caſe, and divide the remainder or ſubſuttle by 168, for the cloff; which being deducted from the ſubſuttle, the remainder will be the nett weight.

EXAMPLE.

What is the nett of 148 cwt. 1 qr. 12 lib. groſs; tare 14 lib. per cwt., trett as uſual, and cloff the common allowance of 2 lib. per 3 cwt.?

$$14 \text{ lib.} = \tfrac{1}{8} \,|\, 148 \quad 1 \quad 22 \quad \text{groſs.}$$

$$18 \quad 2 \quad 5 \quad \text{tare.}$$

$$26)\overline{129 \quad 3 \quad 7} \quad \text{ſuttle.}$$

$$4 \quad 3 \quad 27\tfrac{5}{26} \quad \text{trett.}$$

$$168)\overline{124 \quad 3 \quad 7\tfrac{21}{26}} \quad \text{ſubſuttle.}$$

$$2 \quad 27\tfrac{5}{26} \quad \text{cloff.}$$

Anſ. $\overline{124 \quad 0 \quad 8\tfrac{16}{26}}$ nett.

FACTORAGE.

When one perſon tranſacts buſineſs for another, a certain premium or *commiſſion-money* is allowed him by his employer, which is generally at ſome fixed rate per cent.; and the perſon ſo employed is ſtyled a FACTOR.

RULE.—As L 100 : rate, : : the given ſum : the premium or commiſſion. Or work by aliquot parts.

EXAMPLES.

1. Bought goods for my employer to the amount of L 7480 9 6; What is my commiſſion thereon at 6 per cent.?   a.   c.   L. s. d.   L. s. d.

As 100 : 6 : : 7480 9 6 : 448 16 6¼ Anſ.

Practically.

$5 = \frac{1}{20}$ | 7480   9   6
$1 = \frac{1}{5}$ | 374   0   5½.8   com. at 5 ⎫
       | 74 16 1¾.56 —— at 1 ⎬ per cent.
Anf. L 448 16 6¾.36 —— at 6 ⎭

2. My factor advifes, that he has fold goods on my account to the amount of L 775 13 4, and negotiated bills to the value of L 400 6 8 ; What is his commiffion at 1¾ per cent. ? - - - - - - - Anf. L 20 11 7.

3. If a factor is allowed 4 guineas per cent. ; What may he demand for difburfing L 3400 15 ?

Anf. L 142 16 7½.

INSURANCE, or SECURITY from LOSS.

Note. It is ufually an article in the policy of infurance, that in cafe of lofs the infurer is to be allowed a fmall difcount, commonly 2 per cent. ; fo that the infured receive only L 98 of the L 100 ; and this L 98 is called the fhort recovery.

CASE I.—The fum infured and rate per cent. given ; to find the premium.

RULE.—Compute as in factorage.

EXAMPLES.

1. What premium muft be paid for infuring L 1250 at the rate of 7 per cent. ?

a.   c.   L.   L.   s.
As 100 : 7 :: 1250 : 87 10 Anf.

2. Infured at the *Phœnix fire-office* on my tenement in Caftle-ftreet to the value of L 900 ; What muft I pay annually at 1½ per cent. to keep the policy in force ?

Anf. L 13 10.

CASE II.—The fum infured and rate of difcount given ; to find the fhort recovery.

RULE.—As L 100 : L 100— the difcount, : : the fum infured : the fhort recovery.

EXAMPLES.

1. What is the short recovery of L 2500; discount being allowed at 2 per cent. ?

As 100 : 98 :: 2500 : 2450 short rec. Practically.

$$2 = \tfrac{1}{50} | 2500$$
$$50$$

Ans. L 2450 short rec.

2. The Rattlesnake, bound for Halifax, being lost at sea, on which I had insured L 3480; What sum do I recover, discounting at 2 per cent. ?   Ans. L 3410 8.

CASE III.—The rates per cent. of the premium and discount, and the real value at risk given; to find what sum must be insured to cover the whole outset on a single voyage, &c. That is, to recover from the underwriter the whole value at risk, including premium and discount.

RULE.—Subtract the sum of the premium and discount from L 100. Then, as the remainder : L 100 :: the value at risk : the answer.

EXAMPLES.

1. What sum must be insured to cover L 200; premium 8 per cent. and 2 per cent. discount in case of loss?

a.   c.   L.   L.   L. s. d.
190—10=90 : 100 :: 200 : 222.2=222 4 5½ Ans.

2. If the premium be 12½ per cent. and the discount 2; What sum must be insured to cover L 990 15 ?

Ans. 1158 15 5¼.

3. I am to insure at London L 1000, premium 8 guin. per cent.; at Edinburgh L 800, prem. 8½ guin. per cent.; and at Aberdeen L 600, prem. 8¾ guin. per cent.; Req. the sum to be insured to cover the above sums in their respective places, 2 per cent. being allowed in each in case of loss?

Ans. { L 1116 1 5¼ at London.
        898 2 4¾ at Edinr.
        675 11 7¼ at Aberd.

This rule, by the help of supposed numbers, finds a true answer to many intricate questions, and was in high repute before the knowledge of algebra became so common; and though not so universally practised now, yet it still continues to be of great use.

SINGLE POSITION.

When the answer can be obtained by one supposition.

RULE.—As the result is to the position, ::: the given number : the answer.

EXAMPLES.

1. A schoolmaster being asked how many scholars he had, answered, if I had as many, half as many, and one-eight as many, I should have 315; How many had he?

Sup. 64   Then 168 : 64 :: 315 : 120 Ans.

   64   120

   32   60

    8   15

  168   Proof 315

2. A person's age being asked, made answer, that if to $\frac{1}{6}$ part of his age you add 6 times his age, the sum would be 480; What was his age?

Ans. 77 years, 10 mo. 3 w. 23 h. 21 m. $4\frac{32}{37}$ sec.

3. A farmer being asked how many lambs he had, answered, if I had $\frac{1}{2}$ as many, $\frac{1}{3}$ as many, and $\frac{1}{4}$ as many, I should have 2000; How many had he? - Ans. 960.

4. A general gave the following account of the number of his army, viz. that 4 times as many, $\frac{1}{2}$ as many, $\frac{1}{6}$ as many, and $\frac{1}{12}$ as many, would make 171000; Req. the number of his army? - - - - Ans. 36000 men.

5. A person's age being asked, replied, if $\frac{3}{7}$ of the years I have lived be multiplied by 7, and $\frac{4}{9}$ of this product divided by 3, the quotient will be 40; Req. his age?

Ans. 60 years.

6. A gentleman bought a phæton, horse and harness, for L 120. The horse was valued at twice as much as the harness, and the phæton at double both horse and harness; Req. the value of each?

G

$$
\text{Anf.} \begin{cases} \text{Harnefs} & \text{L } 13 \quad 6 \quad 8 \\ \text{Horfe} - & 26 \quad 13 \quad 4 \\ \text{Phæton} & 80 \quad 0 \quad 0 \end{cases}
$$

Proof 120 0 0

7. A ciftern that holds 800 gallons has 4 unequal cocks; and by opening the 1ft it will be emptied in an hour; by opening the 2d in two hours; the 3d in 3 hours; and the 4th in 4 hours; In what time will it be emptied if all run together? - - - Anf. 28 min. 48 fec.

DOUBLE POSITION.

When any queftion is fo involved that a fimple divifion cannot be adapted to all the conditions of it, it may be refolved by two fuppofitions.

RULE I.—Take any two convenient numbers, and proceed with each according to the conditions of the queftion; and find the differences betwixt the refults and given numbers, which call errors.

II.—Multiply each of thefe errors into the other's pofition; and if both errors are of the fame kind, i. e. both *lefs*, or both *greater* than the given number, divide the difference of the products by the difference of the errors.

III.—If the errors are not of the fame kind, i. e. if the one be *greater*, and the other *lefs* than the given number, divide the fum of the products by the fum of the errors; the quotient in either cafe will be the anfwer.

EXAMPLES.

1. Three partners, A, B, and C, bought a fhip which coft L 2000; of which A paid a certain fum unknown; B paid as much as A and L 50 more; and C paid as much as them both and L 25 more; What did each pay?

1ft. Sup. A pd. L 500	2d. Sup. A pd. L 400
B - - 550	B - - 450
C - - 1075	C - - 875
2125	1725
2000	2000
Error 125 of excefs.	Error 275 defect.

Then $500 \times 275 = 137500$
$400 \times 125 = 50000$

$400\ )187500(468.75$ pd. by A, $\rbrace$
518.75 ——— B, $\rbrace$ Anf.
1012.5 ——— C, $\rbrace$

Proof 2000...

2. A person in play loft $\frac{1}{4}$ of his money, and then won 3s.; after which he loft $\frac{1}{3}$ of what remained, and won 2s.; laftly he loft $\frac{1}{5}$ of what he ftill had, and found he had 12s. remaining; What fum had he at firft? Anf. L 1.

3. At a certain election 375 perfons voted, and the candidate chofen had a majority of 191; How many voted for each? Anf. $\lbrace$ 231 the one.
$\lbrace$ 142 the other.

4. A certain man took his fwine to market, viz. hogs, fows, and pigs, and received for them in all L 50. The price of each hog was 18s. each fow 16s. and each pig 2s. Moreover, there were as many hogs as fows; and for every fow there were 3 pigs; Req. the number of each?

Anf. 25 hogs, 25 fows, and 75 pigs.

5. A gentleman caught a fifh whofe head was 6 inches long; the tail was as long as the head and half the body; and the body juft the length of the head and tail; Req. the particulars? Anf. $\lbrace$ Length of the fifh 48 $\rbrace$
$\lbrace$ ——————— body 24 $\rbrace$ inches.
$\lbrace$ ——————— tail 18 $\rbrace$

6. A gentleman has two horfes, Sprightly and Coarfer: Now, a faddle worth L 50 fet on the back of Sprightly will make his value double that of Courfer, but when fet on the back of Courfer will make his value triple that of Sprightly; Req. the value of each horfe?

Anf. $\lbrace$ Sprightly L 30.
$\lbrace$ Courfer - 40.

SIMPLE INTEREST.

DEF. I.—*Principal* is the fum lent.
II.—*Intereft* is the premium allowed for the loan.
III.—*Amount* is the fum of both principal and intereft.
IV.—*Rate* is fo much per cent. per annum.

PROB. I.—To compute the interest of any sum, for any number of days, at any rate per cent. per annum.

RULE.—Multiply the principal by the number of days it is at interest, and divide the product by 7300, and the quotient will be the interest at 5 per cent. which may be reduced to any other rate by multiplying $\frac{1}{5}$ of the interest so found by the rate proposed ; or the continued product of the principal, number of days, and double the rate, divided by 73000, will quote the interest at any rate per cent.

EXAMPLES.

1. Req. the interest of L 400 for 65 days, at 5 per cent. per annum ?   400

$$\underline{65} \quad \text{L. s. d.}$$

7300)26000(3 11 2¾ Anf.

2. Req. the int. of L 450 10 for 65 days, at 5 per cent. per annum ? - - - - - - Anf. L 4 0 2¾.

3. ——————— L 460 for 32 days, at 4¾ per cent. ? Anf. L 1 18 3¾.

4. ——————— L 552 12 for 41 days, at 4½ per cent.? - - - - - - - - - Anf. L 2 15 10¼.

5. ——————— L 10 15 for 135 days, at 4¼ per cent. ? - - - - - - - - - - Anf. 3s. 4½d.

6. ——————— L 12 19 for 212 days, at 4 per cent.? Anf. 6s.

7. ——————— L 917 9 from 4th Jan. to 19th Aug. at 3½ per cent. ? - - - - - - Anf. L 19 19 4¾.

PROB. II.—To compute the interest of any sum, at any rate, for any number of years, months, days, &c.

RULE.—Divide the continued product of the principal, rate, and time, by 100, and the quotient will be the answer.

EXAMPLES.

1. What is the interest of L 194 for 7 years and 3 months, at 5 per cent. per annum ?

$$\frac{194 \times 5 \times 7.25}{100} = \text{L 70 6 6 Anf.}$$

2. Req. the int. of L 440 for $3\frac{1}{4}$ years, at $3\frac{1}{2}$ per cent. ?
Anf. L 53 18.

3. ——————— L 700 15 for 11 yrs. 200 days, at $4\frac{1}{2}$ per cent. ? - - - - - - - Anf. L 364 3.

4. ——————— L 225 10 for 6 yrs. 41 days, at 5 per cent. ? - - - - - - - - Anf. 68 18 4.

5. ——————— L 3000 for 15 yrs. 4 mo. at $4\frac{1}{4}$ per cent. ? - - - - - - - - Anf. L 1955.

6. ——————— L 444 4 for 4 yrs. 44 days, at 4 per cent. ? - - - - - - - Anf. L 73 4 $3\frac{1}{4}$.

7. ——————— L 303 13 for 5 yrs. 113 days, at $3\frac{3}{4}$ per cent. ? - - - - - - - Anf. L 60 9 $2\frac{1}{4}$.

PROB. III.—*To compute the intereft on bills, bonds, &c. when partial payments are made at no great intervals.*

RULE.—Multiply the principal and feveral balances in their due order by the number of days they are at intereft, and divide the fum of thefe products by 7300, and the quotient will be the legal intereft.

EXAMPLES.

1. Suppofe a bill of L 630 to be due on Jan. 14; L 200 of which is paid March 12; L 120 April 17; and the balance May 24; How much intereft is due, reckoning at 5 per cent.?

Amount per bill, due Jan. 14.   L 630 × 57 = 35910
March 12. Paid to account - - 200
                Bal. - 430 × 36 = 15480
April 17.   Do. - - - - - - 120
                Bal. - 310 × 37 = 11470
May 24.   Paid the bal. - - 310   73|00)62860
                    Anf. L 8 12 $2\frac{1}{2}$

2. A bill of L 708 was due on Feb. 14; of which L 162 was paid on March 13; L 110 on April 17; L 49 on May 3; L 81 on June 26; L 103 on July 4; and the balance on Aug. 21; What intereft is due on the bill?

G 3

PROB. III.—To compute the interest on cash accounts, or any other species of progressive accounts where partial payments are made, or partial debts contracted.

RULE.—Multiply the several balances into the days they are at interest in the order of their dates; and if the balance be sometimes due to the one party, and sometimes to the other, extend the products in separate columns. Lastly, divide the sum of the products by 7300 for the interest, at 5 per cent.

EXAMPLES.

1. Required the interest and balance on the following cash account, from Jan. 1. to Dec. 7. at 5 per cent. ?

Dr. Mr G. Gibb's acct. currt. with Mr R. Stark Cr.

1798,	L.	1798,	L.
Jan. 1. To cash drawn	150	Feb. 3. By cash rem.	160
Feb. 28. To cash do.	110	Apr. 14. By cash do.	170
April 3. To cash do.	219	—— 23. By cash do.	200
May 1. To cash do.	412	May 5. By cash do.	120
—— 22. To cash do.	45	—— 28. By cash do.	510
July 25. To cash do.	427	June 13. By cash do.	50
Aug. 27. To cash do.	104	Aug. 3. By cash do.	40
Oct. 14. To cash do.	300	Sep. 7. By cash do.	108
—— 29. To cash do.	32	Dec. 7. By cash do.	300

1798,		L.	ds.	drafts.	rem.
Jan. 1.	Drawn by Gibb - -	150	33	4950	
Feb. 3.	Remitted by do. - -	160			
	Bal. due by - -	10	25		250
—— 28.	Drawn - - - - -	110			
	Bal. to - - -	100	34	3400	
Apr. 3.	Drawn - - - - -	219			
	Bal. to - - -	319	11	3509	
—— 14.	Remitted - - - -	170			
	Bal. to - - -	149	9	1341	
	Carried over -	-	112	13200	250

		L.	ds.	drafts.	rem.
1798,	Bal. brought forward	149	112	13200	250
Apr.23.	Remitted by Gibb -	200			
	Bal. due by - -	51	8		408
May 1.	Drawn - - - - -	412			
	Bal. to - - -	361	4	1444	
— 5.	Remitted - - - -	120			
	Bal. to - - -	241	17	4097	
—22.	Drawn - - - - -	45			
	Bal. to - - -	286	6	1716	
—28.	Remitted - - - -	510			
	Bal. by - - -	224	16		3584
June 13.	Remitted - - - -	50			
	Bal. by - - -	274	42		11508
July 25.	Drawn - - - -	427			
	Bal. to - - -	153	9	1377	
Aug. 3.	Remitted - - - -	40			
	Bal. to - - -	113	24	2712	
—27.	Drawn - - - - -	104			
	Bal. to - - -	217	11	2387	
Sep. 7.	Remitted - - - -	108			
	Bal. to - - -	109	37	4033	
Oct.14.	Drawn - - - - -	300			
	Bal. to - - -	409	15	6135	
—29.	Drawn - - - - -	32			
	Bal. to - - -	441	39	17199	
Dec. 7.	Remitted - - - -	300			
	Bal. to - - -	141		54300	15750
				15750	

Princ. due by Gibb L 141 0 0 - 7300 38550
Int. due by do. - 5 5 7¼ L 5 5 7¼

Anf. L 146 5 7¼ due by Gibb to Stark.

2. Req. the intereſt and balance on the following caſh account for a year, allowing 5 per cent. when the balance is due to the bank, and only 3½ when due by the bank.

Dr. Mr A. Swan's acct. currt. with Mr J. Young Cr.

1799,	L.	1799,	L.
Jan. 1. To cash drawn	98	Feb. 2. By cash rem.	74
Mar. 3. To cash do.	540	Apr. 4. By cash do.	100
May 4. To cash do.	400	June 19. By cash do.	1700
Aug. 5. To cash do.	170	Sep. 3. By cash do.	300
Oct. 7. To cash do.	1010	Nov. 4. By cash do.	90
Dec. 8. To cash do.	330	Dec. 31. By cash do.	142

1799,		L.	ds.	drafts.
Jan. 1.	To cash drawn - -	98	32	3136
Feb. 2.	By do. remitted -	74		
	Bal. to - - -	24	29	696
Mar. 3.	To do. drawn - -	540		
	Bal. to - - -	564	32	18048
Apr. 4.	By do. remitted -	100		
	Bal. to - - -	464	30	13920
May. 4.	To do. drawn - -	400		
	Bal. to - - -	864	46	39744
June 19.	By do. remitted -	1700		
	Bal. by - -	836	47		39292
Aug. 5.	To do. drawn - -	170		
	Bal. by - -	666	29		19314
Sep. 3.	By do. remitted -	300		
	Bal. by - -	966	34		32844
Oct. 7.	To do. drawn - -	1010		
	Bal. to - - -	44	28	1232
Nov. 4.	By do. remitted -	90		
	Bal. by - -	46	34		1564
Dec. 8.	To do. drawn - -	330		
	Bal. to - - -	284	23	6532
— 31.	By do. remitted -	142	73)833.08	93014
	Bal. due J. Y. banker	142	L 11 8 3	7

Princ. due the bank L. 142	0	0	73)651.098
Int. due do. - - -	11	8	3	L 8 18 4½

Total - L 153 8 3
Int. due by the bank 8 18 4½
Bal. due J. Y. banker L. 144 9 11½

PROB. *V.—When partial payments are made on bills or bonds at intervals greater than a year.*

RULE.—Add the interest due at each payment to the principal, and deduct the payment from the amount.

EXAMPLES.

1. A bond of L 540 was due on Aug. 13, 1793; of which there was paid on March 19, 1794, L 50; Dec. 19, 1795, L 52; Sep. 23, 1796, L 48; Aug. 15, 1797, L 139; Oct. 21, 1798, L 220; Req. the balance due on Jan. 3, 1800?

Aug. 13, 93. Principal per bond - - - L	540.
Int. to Mar. 19, 94==218 days - -	16.126
Amount -	556.126
Mar. 19, 94. Paid to account - - - - -	50.
1st Balance -	506.126
Int. to Dec. 19, 95==1 year, 275 days	44.372
Amount -	550.498
Dec. 19, 95. Paid to account - - - -	132.
2d Balance -	418.498
Int. to Sep. 23, 96==278 days - - -	15.937
Amount -	434.435
Sep. 23, 96. Paid to account - - - - -	48.
3d Balance -	386.435
Int. to Aug. 15, 97==326 days -	17.257
Amount -	403.692
Aug. 15, 97. Paid to account - - - - -	139.
4th Balance -	264.692
Int. to Oct. 21, 98==1 year, 67 days -	15.663
Amount -	280.355
Oct. 21, 98. Paid to account - - - -	220.
5th Balance -	60.355
Int. to Jan. 3, 1800==1 year, 74 days	3.629
Ans. L	63.984

2. Borrowed per bond, dated May 14, 1752, the sum of L 2000, bearing legal interest, upon which I have made the following partial payments, viz.

May 1, 1756.	Paid in to account	L 250
June 11,	60.	Do. - - - -	515
Sep. 7,	69.	Do. - - - -	700
March 9,	78.	Do. - - - -	120
Apr. 21,	84.	Do. - - - -	445
Nov. 7,	90.	Do. - - - -	1100
Dec. 14,	93.	Do. - - - -	756
May 14,	95.	Do. - - - -	874
July 24,	96.	Do. - - - -	1340

What sum must be paid to retire the bond on the first day of the 18th century? - - - Anf. L 2270 19 5¼

PROB. VI.—*To find the present worth of any sum, due at any time hence ; and to find what discount ought to be allowed for prompt payment.*

1.—To compute the present worth.

RULE.—As the amount of L 100 at the rate and time : L 100 : : the debt : its present worth.

2.—To compute the discount.

RULE.—As the amount of L 100 at the rate and time : the interest of L 100 for the same time, : : the debt : the discount.

EXAMPLES.

1. What is the present worth and discount of L 500, due 87 days hence, at 5 per cent. ?

Operation.

101.19178 : 100 : : 500 : L 494 2 2¾ pref. worth.
101.19178 : 1.19178 : : 500 :   5 17 9¼ discount.
               L 500 0 0⅔ proof.

2. What is the present worth and discount of L 701 for 108 days, at 5 per cent ?

Anf. { L 690 15 7¼ present worth.
           10 4 4¼ discount.

3. What ready money will take up a bill of L 1200, due 40 days hence, discounting interest at 4¾ per cent.?

4. What ready money will take up a bond of L 2000, payable at 145 days distance ?

Prob. VII.—To find the time in which any given sum will amount to any other sum, at any rate per cent.

RULE.—As the interest of the given principal for 1 year, at the given rate : 1 year, : : the whole interest : the time required.

EXAMPLES.

1. In what time will L 600 become L 640, at 5 per cent. ?   30 : 1 :: 40 : 1.3 = 1 year, 4 mo. Anſ.

2. In what time will L 840 become a ſtock of L 900, at 5 per cent. ?   Anſ. 1 year, 5 mo. 4 days.

PRACTICAL METHOD OF DISCOUNTING BILLS.

Bankers that keep money for the purpoſe of diſcounting bills, generally add three days of grace to the time the bill has to run, and calculate the intereſt for the whole. Some likewiſe charge a ſmall commiſſion for their trouble, which, with the intereſt, they deduct from the content of the bill, and pay the balance to him for whom the diſcount is made.

EXAMPLES.

1. A bill of L 420, payable Aug. 2, is preſented at the bank for diſcount on April 7 ; What ſum does the banker pay after deduction of intereſt and ½ per cent. commiſſion ?

$$\frac{1}{2} = \frac{1}{200} \Big| \begin{array}{l} 420 \\ 120 \end{array}$$

$$73\,|\,00\,|\,50400$$

$$6.904 \text{ intereſt.}$$
$$\underline{2.1 \text{ commiſſion.}}$$
$$9.004$$

Anſ. L 410.996 = L 410 19 11

2. Diſcounted A B's bill of L 320 18 on June 3, payable October 19, for which received ¼ per cent. commiſſion ; What ſum muſt he receive? Anſ. L 313 17 11¼.

3. What ready money will take up a bill of L 500
payable 73 days hence, allowing ½ per cent. commiſſion
　　　　　　　　　　　　　　　Anſ. L 494

4. A bill of L 89 10, payable at 107 days diſtance,
is to be diſcounted ; What ſum will the porteur receive,
reckoning legal intereſt ?　　　　　Anſ. L 88 3 9

COMPOUND INTEREST.

Compound intereſt is that which ariſes from both
principal and intereſt taken together, at the end of each
ſtated time when the intereſt becomes due.

RULE.—Multiply the amount of L 1 for a year into
itſelf as often as there are years propoſed, abating 1 ; then
the laſt product multiplied by the principal will give the
amount ; and if from the amount you ſubtract the prin-
cipal, the remainder will be the compound intereſt.

EXAMPLES.

1. Req. the amount of L 400 for 4 years, compound
intereſt, at 5 per cent. per annum ?　L.

```
       1.05            20|400
       1.05      Or thus.   20
      ─────              ────────
       525              20|420══1ſt year.
       105                  21
      ──────            20|441══2d year.
      1.1025               2205
       1.05            20|463.05══3d year.
      ─────               231525
       55125          Anſ. L 486.2025══4th year.
      11025
      ────────
      1.157625
       1.05
      ─────
      5788125
     1157625
     ──────────
     1.21550625
         400
```

Anſ. L 486.2025 . . . .

2. What is the amount of L 700 forborn 5½ years, at
5 per cent. per annum, compound intereſt ?
　　　　　　　　　　　　　　Anſ. L 904 11 3¼.

Note. When there are months, &c. beyond complete years, take proportional parts of the amount for even years, which, added, will give the amount. *See the Key to the Text Book.*

3. What will L 500 amount to in 12 years and 9 months, at 5 per cent. per annum, compound interest?

Anf. $\begin{cases} \text{L 931 12 amount.} \\ \text{431 12 interest.} \end{cases}$

EQUATION OF PAYMENTS.

When a debt becomes due at different periods of time, the finding of a mean time at which the whole may be difcharged, without lofs to either party, is called equating the terms of payment.

RULE I.—Multiply the feveral payments into their refpective times, and divide the fum of the products by the fum of the payments; the quotient will be the equated time nearly.

EXAMPLES.

1. The fum of L 800 was to have been paid as under, viz. L 300 at 4 months; L 400 at 9 months; and the remaining L 100 at 12 months; but the parties agree to pay the whole off at once; Req. the equated time?

$$300 \times 4 = 1200$$
$$400 \times 9 = 3600$$
$$100 \times 12 = 1200$$
$$\overline{800} \qquad |\overline{6000}$$

Anf. $7.5 = 7\frac{1}{2}$ mo. the equated time.

2. L 1200 is to be paid as follows, viz. L 150 at 2 months; L 300 at 3 months; L 400 at 6 months; L 250 at 10 months; and the balance at 12 months; Req. the equated time when the whole may be paid without prejudice to either party? - - - - - - Anf. 6.083 months.

3. Bought a certain quantity of goods on credit; and, according to bargain, was to pay $\frac{1}{4}$ of the price at the end of every 3 months, till the whole fhould be difcharged:

H

Now, I wish to pay the whole at one time; Req. the equated time? - - - - - - - Anf. $7\frac{1}{2}$ months.

Note. The foregoing rule is not strictly true; for if a person retains money in his hand after it becomes due, he gains the *interest* of it for the time; but if he pays money before it is due, he loses only the *difcount*, which is always lefs than the interest by the interest of the difcount for the time. But as this error is so trifling, the above is generally ufed in bufinefs: Yet thofe who choofe to be nice in calculation may take the following,

RULE II.—Firft, find the prefent worth of each debt; then find in what time the fum of the prefent worths will amount to the fum of the debts. Let Ex. 1ft be refumed.

$$
\left.
\begin{array}{l}
106 : 100 :: 300 : 295.0819672 \\
103.75 : 100 :: 400 : 385.5421686 \\
105 : 100 :: 100 : \underline{95.2380952}
\end{array}
\right\} \text{prefent worths.}
$$

$$775.862231$$

$100 : 5 :: 775.862231 : 38.78311155 = 1$ year's interest.

1 year's int. whole int.   mo. mo. w. d. h.

$38.78311155 : 24.137769 :: 12 : 7$ 1   6   2, true time.

Hence, the true equated time is found to be 7 months, 1 week, 6 days, and 2 hours, which is only 22 hours fhort of the equated time by Rule 1ft, and is no great confideration in the courfe of a year.

EXCHANGE OF MONEY.

DEF. I.—*Exchange* is the trade of money carried on between different countries, by giving money or value in the one, and receiving a bill or draught on the other.

II.—*The courfe of exchange* is the rate at which bills are bought or fold.

III.—*Par* is the intrinfic value of any piece of money in one country compared with that of another.

IV.—*Agio* is the difference betwixt *bank* and *current* money in foreign countries.

V.—*Ufance* is a certain fixed time agreed on between two places for the payment of bills of exchange.

I.—With LONDON.

RULE.—Work by practice.

EXAMPLES.

1. A merchant in Edinburgh drew on his correspondent in London for L 418 10; premium $\frac{1}{4}$ per cent.; How much was paid for the bill at Edinburgh?

$$\begin{array}{l} \frac{1}{2} = \frac{1}{200} \mid 418.5 \\ \frac{1}{4} = \frac{1}{2} \mid 2.0925 \\ \phantom{\frac{1}{4} = \frac{1}{2} \mid} \underline{1.04625} \end{array}$$

Anf. L 421.63875 = L 421 12 9$\frac{1}{4}$

2. Glafgow drew on London for L 1000; premium $\frac{1}{2}$ per cent.; What did the bill coft at Glafgow?
                              Anf. L 1005.

3. A merchant in Aberdeen is indebted to his friend in London to the amount of L 3000; What will it coft him to procure bills on London for the amount; exchange at $\frac{1}{4}$ per cent.? - - - - - - Anf. L 3007 10.

4. A merchant in Glafgow owes his correspondent in Manchefter L 444 4; What will a London bill for the amount coft him; premium $\frac{1}{5}$ per cent.? Anf. L 445 1 9.

II.—With IRELAND.

In Ireland accounts are kept as in Britain, and the par of L 100 fterling is L 108 6 8; but the courfe or price of bills is variable, and generally runs between 6 and 12 per cent.

PROB. I.—To reduce Irish to sterling.

RULE.—As L 100 with the courfe added : L 100 :: the given Irifh : the required fterling.

EXAMPLES.

1. In L 384 Irifh, How much fterling; exch. at 109? As 109 : 100 :: 384 : L 352 5 10$\frac{1}{4}$ Anf.

2. In L 704 15 Irifh, How much fterling; exch. at 110? - - - - - - - - - - Anf. L 640 13 7$\frac{1}{4}$.

3. Gained a prize of L 2000 Irifh in the Irifh lottery; For how much may I draw when the exchange is at 107?
            H 2   Anf. L 1869 3 2.

PROB. II.—*To reduce sterling to Irish.*

RULE.—As L100 : L100 with the course added, : :
the given sterling : the required Irish.

EXAMPLES.

1. In L770 12 sterling, How much Irish; exch. at 108?
2. In L901 17 sterl. How much Irish; exch. at 106?
3. A merchant in Edinburgh remits to his correspon-
dent in Dublin L880 sterling; For how much Irish will
he be credited there; exch. 110? - - Anf. L968.

III.—WITH AMERICA AND THE WEST INDIES.

In America accounts are kept as in Britain, only their
money is called currency. The course of exchange is
fluctuating, but always inferior to sterling.

PROB. I.—*To reduce currency to sterling.*

RULE.—As the equivalent currency of L100 : the
given currency, : : L100 : the required sterling.

EXAMPLES.

1. Philadelphia remits to Britain per bill L640 9 cur-
rency; How much sterling will the bill amount to when
the exchange is 165 per cent.?

a.   c.   currency. sterling.
As 165 : 100 : : 640.45 : 388 3 3½ Anf.

2. In L9475 10 Jamaica currency, How much ster-
ling; exch. at 140 per cent.? - Anf. L6768 4 3¼

3. When a mechanic receives 6s. 6d. per day at Phi-
ladelphia, and in Britain only 2s. 6d. What is the dif-
ference of the wages per day; exch. 175 per cent.?
Anf. Better at Philadelphia by 1s. 5½d. sterl. per day.

4. A horse was sold at New-York for L215 currency;
Req. the amount in sterling when the exchange is 180
per cent.? - - - - - - - - Anf. L119 8 10½.

5. An Edinr. merchant in balancing his books finds
there is due him in Jamaica L3440 8 cur. exch. 145;
in St Kitt's L880 cur. exch. 148; in Virginia L1400
cur. exch. 155; in New-York L998 15 cur. exch. 154

per cent.; What sum stands in the sterling column of his ledger? - - - - - - - Ans. L 4519 0 11¼.

PROB. II.—*To reduce sterling to currency.*

RULE.—As L 100 sterling : the given sterling, : : the equivalent currency : the required currency.

EXAMPLES.

1. Boston remits to Britain per bill L 640 12 sterling; How much currency did the bill cost at Boston; exch. at 170 per cent.? - - - - - Ans. L 1080 0 4¼.

2. A merchant in Glasgow ships off for Virginia goods to the amount of L 997 17 sterling; For how much currency will he have credit in Virginia when the exchange rates at 160 per cent.? Ans. L 1596 11 2¼.

3. A trading company in Glasgow consign to their factor in New-York goods to the amount of L 5000 sterling, prime cost at Glasgow. The goods were sold at 96 per cent. advance on the invoice currency for sterling; Req. the amount in cur. when the exchange is at 140 per cent.? - - - - - - - Ans. L 13720 cur.

4. A gentleman in Britain purchased an estate of 15000 acres of land in Kentucky, at L 625 sterling; Req. the price per acre in sterling and in currency when the exch. is at 176 per cent.? Ans. 10d. sterl. and 17¼d. ⅔ cur. per ac.

5. An American merchant consigned to his factor in Greenock 648 hhds. of flax-seed, which he sold at L 3 sterling per hhd.; How much currency must the factor remit after deducting his own commission at 2½ per cent. and L 15 for cellar rent, &c. when the exchange is at 154 per cent.? - - - - Ans. L 2896 7 10¼ cur.

IV.—WITH HOLLAND.

In Holland there are two sorts of money, viz. *bank* and *currency.* The bank is generally rated from 3 to 6 per cent. better than the current; and bills of exchange are always negotiated in bank. The par of L 1 sterl. is 36s. 6d. Flemish banco; and the course runs from 30. to 40 schil. per pound sterling.

H 3

Value in sterling.

			L	s	d	
16 Pennings	=	1 Stiver	= L 0	0	1	$\frac{7}{73}$
20 Stivers	=	1 Guilder	= 0	1	$9\frac{3}{4}$	$\frac{40}{73}$
6 Guilders	=	1 Pound Flem.	= 0	10	$11\frac{1}{2}$	$\frac{2}{73}$
2 Guilders	=	1 Dollar	= 0	3	$7\frac{3}{4}$	$\frac{25}{73}$
$2\frac{1}{2}$ Guilders	=	1 Rixdollar	= 0	4	$6\frac{3}{4}$	$\frac{13}{73}$
$5\frac{1}{4}$ Guilders	=	1 Ducat	= 0	9	7	$\frac{5}{73}$

2 Grotes or pence Flem. = 1 Stiver.
40 Grotes - - - - = 1 Guilder.
12 Grotes - - - - = 1 Schilling.
80 Grotes - - - - = 1 Dollar.
240 Grotes - - - - = 1 Pound Flem.

Prob. I.—*To reduce currency to banco.*

Rule.—As L 100 + agio : 100 :: currency : banco; and to reduce banco to currency, the contrary.

EXAMPLES.

1. In 8040 current guilders, How much banco; agio 4 per cent.?   a.   c.   cur.   banco.
104 : 100 :: 8040 : 7730.769 Anf.

2. In 9054 cur. guil. How much banco; agio 3 per cent.? - - - - - - - - - Anf. 8790.291 b. g.

3. Red. 1234 cur. guil. to banco; agio 5.

4. —— 7744 ban. guil. to cur. agio 3. Anf. 7976.32.

Prob. II.—*To reduce Dutch or Flemish money to sterling.*

Rule.—As the equivalent Dutch : the given Dutch, :: L 1 sterling : the required sterling; and to reduce sterling to Dutch, the contrary.

EXAMPLES.

1. In L 875 15 Flemish banco, How much sterling; exch. at 36s. 8d. per pound sterling? Anf. 477 13 $7\frac{1}{2}$.

2. In L 7854 14 Flemish cur. How much sterling; exch. at 37s. 6d. and agio 4 per cent.? Anf. L 4028 1 $0\frac{1}{4}$.

3. Red. 7400 guilders banco to sterl. exch. at 35s. 9d.
Anf. L 689 19 $6\frac{1}{2}$.

4. Leith is indebted to Amsterdam in 8172 guilders banco; How much sterl. will pay the debt; exch. 37s. 9d.?

5. Dundee remits to Rotterdam L 726 8 ; Req. the amount in current guilders ; exch. 37s. 3d. and agio 4 ?

Anf. 8442.2208 cur. guil.

6. A merchant in Edinburgh owes his correspondent in Amsterdam L 1556 7 4 Flemish ; How much sterling will pay the debt when the exch. is at 34s. 9d. ?

Anf. L 895 15.

7. When the exch. is at 38s. 6d. What is the value of the bank guilder ? - - - - Anf. 1s. $8\frac{3}{4}$d. $\frac{5}{7}\frac{4}{7}$.

8. When the exch. is at par, What is the sterl. value of the Flemish pound ? - - - - Anf. 10s. $11\frac{1}{2}$d.

9. When the guilder banco sells at Edinburgh for $22\frac{1}{2}$d. What is the courſe of exch. betwixt Britain and Holland ?

Anf. 35s. $6\frac{1}{2}$d.

10. If the pay of a British ſailor be L 1 12 per month, and that of a Dutch ſailor 16 guilders ; Which of the two has the advantage when the exch. is at 37s. 6d. ?

Anf. The British ſailor is better by 3s. 6d. ſterling.

11. When the exch. is at 37s. 6d. What is the value of the bank guilder ?

Flem. Flem. ſterl. ſterl.

1.875 : 1 :: 1 : .53 $=$ L 1 Flem.

Then .53 $\div$ 6 $=$ .08 $=$ 1s. $9\frac{1}{4}$.3d. Anf.

V.—With HAMBURG.

In Hamburgh accounts are kept in marc-lubs, or *marcs of Lubeck*, ſchilling-lubs, and phennings. The agio runs from 15 to 40 per cent.

Exch. with { Britain, at ſo many ſchil. groſs per L ſterl.
Holland, about 33 ſtiv. ban. per dol. of Ham.
France, about 26 ſchil. lubs per ecu.

Value in sterling.

			L		
12 Phennings	$=$ 1 Schilling-lub	$=$	L 0	0	$1\frac{1}{8}$
16 Schilling-lubs	$=$ 1 Marc-lub	$=$	0	1	6
$7\frac{1}{2}$ Marc-lubs	$=$ 1 Pound Groſs	$=$	0	11	3
2 Marc-lubs	$=$ 1 Dollar	$=$	0	3	0
3 Marc-lubs	$=$ 1 Rixdollar	$=$	0	4	6
$6\frac{1}{4}$ Marc-lubs	$=$ 1 Ducat	$=$	0	9	$4\frac{1}{2}$

RULE.—Reduce the Hamburg money to Flemish; then compute as with Holland.

1. Hamburg is indebted to Edinburgh in L 400 sterling; How many marcs must be paid in Hamburg when the exch. is 34s. 6d. Flemish banco per pound sterling?

Flem. Flem. marcs. marcs.

As 1 : 1.725 :: 7½ : 12.9375 in L 1 sterling.

$$\underline{400}$$

Anſ. 5175 .... marc-lubs.

Note. As 40 grotes make a guilder of Holland, and 32 grotes a marc of Hamburg; therefore, guilders multiplied by 5 and divided by 4, make marcs; and marcs multiplied by 4 and divided by 5, make guilders.

2. In 7480 marc-lubs-banco, How much sterling, when the exch. is at 33s. 6d. Flemish banco per pound sterling? - - - - - - - - Anſ. L 595 8 9½.

3. In L 87 4 9, How many marc-lubs cur. agio 20, and exch. 33s. 10d. Flemish banco per pound sterling? Anſ. 1328.1908 marcs.

4. Hamburg is indebted to Britain in 4056 marcs, 8 ſchil. lubs; Req. the amount in ſterl. when the exch. is at 34s. 3d. Flemiſh banco per pound ſterling?

Anſ. L 315 16 8¼.

5. Leith is indebted to Hamburg in 3344 ſchil. lubs; How much ſterling will pay the debt when the exch. is at 34s. 3d. Flemish banco per pound ſterling?

Anſ. L 16 5 5½.

6. In 840 marc-lubs cur. agio 30, and 340 rixdollars cur. agio 25, How much ſterl. exch. 35s. 8d. Flemiſh banco per pound ſterling? - - Anſ. L 110 15 1¼.

7. When the exch. is at 34s. 6d. Flemiſh banco per pound ſterling, Req. the value of the marc lub banco?

F. Flem. m. marcs. d. s. d.

As 1 : 1.725 :: 7.5 : 12.9375)240(1 6½ Anſ.

8. When the exch. is 34s. 9d. Flem. ban. What is is the value of the marc-lub. cur. agio 25? Anſ. 1s. 2¾d.

9. A Dundee merchant conſigned to his factor in

Hamburg 480 gallons whisky, which were sold at 5 marcs, 8 schil. per gallon; 560 gallons rum, at 9 marcs, 10 schil. per gallon; and 98 cwt 3. qrs. sugar, at 42 marcs, 12 schil. per cwt. The freight, duty, &c. amounted to 400 marcs; Req. the Hamburg bill of sales, and the sterling to be remitted by the factor, allowing him 2 per cent. commission; exch. 35s. 6d. Flem. ban. per pound sterling? - Ans. 12251.5625 marcs==L 872 9 0¾.

VI.—With FRANCE.

The French keep accounts in livres, sols, and deniers.

Value in sterling.

12 Deniers == 1 Sol - - - - - ==	0	0	0½
20 Sols == 1 Livre - - - - - ==	0	0	10
3 Livres ==1 Ecu or Crown Tournois ==	0	2	6
10 Livres == 1 Pistole - - - - ==	0	8	4
24 Livres == 1 Louis-d'or - - - ==	1	0	0

Exch. with {
Britain on the ecu; par 29½d.
Hamburg, about 26 schil. lubs per crown.
Holland, about 28 stivers per crown.

RULE.—Compute either by practice, reduction, or compound multiplication.

EXAMPLES.

1. Red. 7490 livres, 15 sols to sterling; exch. at 2s. 6d. per ecu.

By reduction.

3|7490·75

2496.916

2½

49938333
12484583

20|6242.2916

312.11458==L 312 2 3½ Ans.

By practice.

3|7490·75

2s. 6d. == ⅛|2494.916

312.11458==L 312 2 3½

2. Red. 481 liv. to sterl. exch. 30½d. Ans. L20 7 6¼.

3. —— 490 liv. to sterl. exch. 29d. Ans. L19 14 8¼.

4. —— L172 18 to liv. exch. 31½d. Ans. 3952 liv.

5. Red. L.771 14 to crs. ex. 31½d. Anf. 5879.619 crs.

6. —— 304 guin. to liv. exch. 32d.   Anf. 7182 liv.

7. —— 444 liv. to marc-lubs; exch. at 27 fchil. lubs.
                              Anf. 249.75 marc-lubs.

8. —— 533 liv. to guil. exch. 28½ ftiv. Anf. 253.175 guil.

9. —— 999 liv. to cur. guil. exch. 27, and agio 4.
                              Anf. 467.532 cur. guil.

10. A merchant in Leith imports from France 8412 pinees of yarn, at 15 livres, 9 fols, 9 deniers per pinee; How much fterling will pay the account when the exch. is at 32¼d. per ecu ? - - - - - Anf. L 5945 2.

11. Glafgow fhips for France 54 hhds. tobacco, weighing nett 81891 lib. at 6½ per lib. ; For what fum will France credit Britain when the exch. is 32¼ per ecu ?
                         Anf. 16505.162 French crowns.

VII.—With SPAIN, on the Piaftre ; par 3s. 7d. fterl.

The Spanifh money is of two forts, viz. *vellon* and *old plate*. A rial vellon is worth 8½ quartas, copper money; and the rial old plate is worth 16 of the fame quartas, which makes a difference betwixt them in the proportion of 32 to 17, or 53⅛ per cent.

				Value in fterling.		
				L	s	d
4	Marvadies	= 1 Quarta	= L 0	0	0½.5	
8½	Quartas	= 1 Rial	=	0	0	5¼.5
8	Rials	= 1 Piaftre	=	0	3	7
5	Piaftres	= 1 Piftole	=	0	17	11
2	Piftoles	= 1 Doubloon	=	1	15	10

The courfe of exchange between Britain and Spain is generally below par, from 35d. to 42d. per piaftre ; and bills of exchange are always negotiated in plate.

Rule.—When *vellon money* is given, bring it to plate, thus. As 32 : 17 :: vellon : plate. Then to fterling, by practice.

EXAMPLES.

1. In 49480 rials vellon, How much fterling ; exch. at 42d. per piaftre ?

8

$$32 : 17 :: 49480 : 26286.25 \text{ rials plate.}$$

$$3s. \; 4d. = \tfrac{1}{6} \Big| \; 3285.78125 \text{ piastres.}$$
$$2d. = \tfrac{1}{16} \Big| \; 547.630208$$
$$27.381510$$

Anf. L 575.0117 18

2. Red. 4488 r. plate to fterl. exch. 41d. Anf. L 95 16 9.

3. — 5042 piaft. to fterl. exch. 40½d. Anf. L 850 16 9.

4. — 988400 quartas to fterl. exch. 40d.

Anf. L 2422 10 11¾.

5. — 108 piftoles to fterl. exch. 37½d. Anf. L 84 7 6.

6. — L 48 7 fterl. to r. p. exch. 36d. Anf. 2578.6 r. p.

7. Bought goods in Cadiz to the amount of 8885 rials vellon ; How much fterl. will pay the acct. when the exch. is at 40d. per piaftre ? - - Anf. L 98 6 8¼.

8. If I pay a Madrid bill here of L 3000 ; For how much Spanifh muft I draw when the exch. is 42d. per piaftre ? - - - - - - Anf. 17142.857 piaftres.

VIII.—With PORTUGAL.

			Value in fterling.
1000 Rees	= 1 Milree	- - =	L 0 5 7½
400 Rees	= 1 Crufade of exch. =		0 2 3
20 Rees	= 1 Vintin	- - =	0 0 1¼ ⅔
5 Vintins	= 1 Teftoon -	- =	0 0 6¾
48 Teftoons	= 1 Moidore -	- =	1 7 0

Exch. with { *Britain* on the milree ; par 5s. 7½d. fterl.
Holland, about 50 grotes per crufade.
France, about 400 rees per ecu.

RULE.—Compute either by practice or reduction.

EXAMPLES.

1. In 1640 milrees, How much fterling ; exch. at 5s. 4d. per milree ?

By practice.			By reduction.
4s. $=\frac{1}{5}$	1640		1640
1s. $=\frac{1}{4}$	328		64
4d. $=\frac{1}{3}$	82		656
	27 6 8		984
Anf. L	437 6 8		12)104960

2|0|874|6 8

Anf. L 437 6 8

2. Red. 8000 mil. to fterl. exch. 5s. 5d.

Anf. L 2166 13 4.

3. — 4950 mil. to fterl. exch. at 5s. 6d. Anf. L 1361 5.

4. — L 400 15 fterl. to mil. exch. 5s. 6½d.

Anf. 1446.315 mil.

5. — L 300 fterl. to cruf. exch. at par. Anf. 2666.6 cruf.

6. — 9900 vintins to fterl. exch. 5s. 3d. Anf. L 51 19 6.

7. — 4444 teftoons to fterl. exch. 5s. 4¾d.

Anf. L 119 17 10¾.6

8. — 3400 mil. to Flem. exch. at 51 grotes.

Anf. L 1806 5 Flem.

9. — 4896 r. to liv. ex. 400 r. per ecu. Anf. 3672 liv.

10. A factor in Lifbon fells for his employer in London 7480 yards of broad cloth, at 3 mil. 256 rees per yard; Req. the Lifbon bill of fales, and fterling to be remitted home, allowing the factor 2½ per cent. commiffion when the exch. is at par ?

Anf. $\begin{cases} 24354.88 \text{ Lifbon bill of fales.} \\ \text{L 6678 11 3½ to be rem. home.} \end{cases}$

IX.—WITH RUSSIA.

The Ruffians keep their accounts in rubles and copecks.

Value in fterling.

25 Copecks	= 1 Polpolitin	= L 0 1 2¼
2 Polpolitins	= 1 Politin	= 0 2 3
2 Politins	= 1 Ruble	= 0 4 6
2 Rubles	= 1 Ducat	= 0 9 0

Exch. with $\begin{cases} \textit{Britain} \text{ on the ruble ; par 4s. 5d. fterling.} \\ \textit{Holland,} \text{ about 50 ftivers per ruble.} \\ \textit{Hamburg,} \text{ about 110 copecks per rixdollar.} \end{cases}$

RULE.—Compute either by practice or reduction.

EXAMPLES.

1. In 825000 copecks, How much sterling; exch. at 4s. 6d. per ruble?

By practice.

100)825000

4 = ½|8250
6 = ¾|1650
   46 | 206 5

Ans. L 1856 5

By reduction.

8250
4½

33000
4125

20)37125

Ans. L 1856 5

2. Red. 1636 rubles to sterl. exch. 4s. 5½d.
Ans. L 364 13 10

3. — L 161 12 3½ to rub. exch. 4s. 5½d. Anf. 725 rub.

4. — 725 rub. to sterl. ex. 4s. 5½d. Anf. L 161 12 3½.

5. — 7773 duc. to sterl. ex. 4s. 6¼d. Anf. L 3449 5 4½.

6. — 4744 politins to sterl. ex. 4s. 7d.

7. Edinr. is indebted to Petersburg in 7766 rubles; For how much sterling may the Russian merchant draw when the exch. is at 4s. 6d. per ruble? Anf. L 1747 7.

8. If the annual income of a Russian nobleman be 898800 rubles; How much sterling has he per week when the exch. is at 4s. 4¾d.? Anf. L 3799 0 3¼ 11/13.

X.—WITH THE EAST INDIES.

Value in sterling.

10 Fanams	= 1 Rupee	=	L 0 2 6
100,000 Rupees	= 1 Lack of Rup.	=	1250 0 0
100 Lacks	= 1 Crore	=	125000 0 0
36 Fanams	= 1 Pagoda	=	0 9 0

EXAMPLES.

1. In 48804 fanams, How much sterling; exch. at 31d. per rupee?

d.   12
48804 × 31 = 1512924
2|0|126077

Ans. L 6303 17

I

2. A gentleman in India has a fortune of 21 lacks of rupees annually; What does it amount to in sterling when the rupee is valued at 2s. 6d.?   Anf. L 26250.

DRAWING AND REMITTING.

As the courfe of exchange is variable, the drawing or remitting of money may be attended either with lofs or advantage. It is evident, that the lefs value the money of a merchant's own country bears abroad, the more he will gain by *drawing*, and lofe by *remitting;* and the greater its value, the contrary. Therefore, when the exchange is on *fterling money*, the British merchant will gain by remitting when the courfe is *high*, and drawing when it is *low;* but when on the *foreign piece*, he will gain by drawing when the courfe is *high*, and remitting when it is *low*.

EXAMPLES.

1. What is gained or loft by remitting to Amfterdam L 1000 when the exch. is at 34s. 6d., and drawing when it is at 34s.?

$$\text{As } 1.7 : 1.725 :: 1000 : 1014\ 14\ 1\tfrac{1}{4}$$
$$1000$$

Anf. L 14 14 1¼ gained.

2. What is loft or gained by remitting to France L 500 when the exch. is at 31d. per ecu, and drawing when it is fallen to 30d.?

$$\text{As } 31 : 30 :: 500 : 483\ 17\ 5$$
$$500$$

Anf. L 16 2 7 loft.

3. When bills on France fold at 30d. per ecu, Edinr. remitted to Bourdeaux L 8400. When bills had rifen to 30½d. Edinr. drew for the amount; What advantage attended the negotiation?   Anf. L 140 = 1⅔ per cent.

4. Remitted L 800 to Spain when the exch. was at 40d. per piaftre, and drew for the value when at 41d.; What was gained or loft? - - - Anf. L 20 gained.

ARBITRATION is the method of finding such a rate of exchange betwixt any two distant places, which shall be in proportion to the rates of exchange in the intermediate places through which the circulation is to pass.

RULE.—Proceed as in proportion, by placing the given odd term on the right, and disposing of each pair of like terms accordingly.

EXAMPLES.

1. When bills on Paris sell at Amsterdam for $55\frac{1}{4}$ grotes per ecu, and on London at 34s. 6d. Flemish per pound sterling; How should bills on Paris be rated at London to be on par with the other two places?

grotes. grotes.　　d.　　d.

$414 : 55\frac{1}{4} :: 240 : 32$ per ecu, Ans.

2. If bills on Amsterdam sell at London for 33s. 9d. Flemish per pound sterling, and on Paris at 32d. per ecu; Req. the rate of exchange betwixt Amsterdam and Paris to be at par with the other two?

a.　　c.　　grotes. grotes.

As $240 : 32 :: 405 : 54$ per ecu, Ans.

3. A banker in Edinr. remits to Spain L 1000 via Holland, at 35s. per pound sterling; thence to France at 58 grotes per crown; thence to Venice at 100 crowns per 60 ducats; and thence to Spain at 360 marvadies per ducat: For how many piastres of 272 marvadies will the Edinr. banker be credited in Spain?

a.　　c.　　a.　　c.　　a.　　c.　　　　L.

$272 : 360 :: 100 : 60 :: 58 : 35 :: 1000$　piastres.

Abr. $34 : 45 :: 5 : 3 :: 29 : 210 :: 1000 : 5750.507$.

4. A Glasgow merchant has 7000 guilders due him in Amsterdam, and is offered 22d. sterling for each guilder; but not being pleased with the offer, indorses a bill for the whole to his factor at Paris, who brought the money to France by exchanging at 55 grotes per ecu, which he remitted his employer at Glasgow at the rate of 32d. sterl. per ecu, retaining $\frac{1}{2}$ per cent. com. Which of the ways was most advantageous to the Glasgow merchant?

I 2

a. c. a. c. guild.
240 : 32 :: 55 : 40 :: 7000 : L 678 15 9
 Deduct factor's commission   3 7 10¼
  Per cirulation - - - - 675 7 10¾
  Per the offer - - - - 641 13 4
 Gained by circulation - - L 33 14 6¾

Thus, a person thoroughly acquainted with this rule may trace out a path for circulating his money to great advantage; and thus, his skill in arbitration may be to him a source of wealth.

INVOLUTION, or RAISING of POWERS.

INVOLUTION is the multiplying of a number into itself any number of times required. The number itself is called the root, or first power. If it be multiplied once into itself, the product is called the square, or second power; if twice, the cube, or third power; if thrice, the biquadrate, or fourth power; and if four times, the surfolid, or fifth power.

TABLE OF POWERS.

Roots	1	2	3	4	5	6	7	8	9
Squares	1	4	9	16	25	36	49	64	81
Cubes	1	8	27	64	125	216	343	512	729
Biquadrates	1	16	81	256	625	1296	2401	4096	6561

EVOLUTION, or EXTRACTION of ROOTS.

Prob. I.—To extract the SQUARE ROOT.

RULE I.—Divide the given number into periods of two figures each, beginning at the place of units.

II.—Find the greatest square in the left hand period, which place underneath, and its root in the quotient; subtract the square from the period, and to the remainder annex the following period for a dividend.

III.—Double the root for a divisor, and find how often it is contained in the dividend, excluding the place of units; set the result both in the quotient or root and units place of the divisor.

IV.—Multiply the divisor thus increased by the last figure in the root; subtract the product as before; annex another period; and so on to the last.

Note. If there are decimals in the given number, they must be pointed off into periods towards the right.

EXAMPLES.

1. Req. the square root of 54756?

```
54756(234 Anf.
  4
43)147
   129
464)1856
    1856
```

(2.) Req the sq. root of 1190.25?

```
1190.25(34.5 Anf.
   9
64)290
   256
685)3425
    3425
```

Proof. The square of the root with the remainder added (if any), will exactly equal the given number.

3. Req. the square root of 1347.875? Anf. 36.713
4. ——————— 460905.21? Anf. 678.9
5. ——————— 1719432.9? Anf.

PRACTICAL QUESTIONS.

1. A gentleman has a garden of an irregular form, that measures 119716 square links, which he wishes to exchange for a square one of equal content; Req. the side of the square? - - - - - - - Anf. 346 links.

2. The diameter of a cooler is 4 feet; Req. the diameter of another that will contain 3 times the quantity? Anf. 6.92 feet.

3. What length of a rope tied to a cow's tail will allow her to graze just one half of a Scots acre, supposing the length of the cow and tail together to be 9 feet? Anf. 27.27 yards.

4. In a square plantation containing 3182656 trees; Req. the length of its side when there are 21 feet betwixt each row? - - - - - - Anf. 12481 yards.

5. Suppose the length of a horse's tether to be 27 feet, which allows him to eat 2290.2264 square yards; How

I 3

many additional yards will he have liberty to eat, by lengthening his tether 9 feet? - Anf. 537.2136 yards.

6. If the area of a circle be .7854; Req. the fide of a square that contains 4 times the area? - Anf. 1.77

7. Right fouth of the manfe, at the diftance of 7 fur-longs, ftands the kirk; and 2 miles due eaft of the fame, ftands the mill; Req. the diftance betwixt the kirk and the mill? - - - - - - - - Anf. 2.183 miles.

8. In a gentleman's pleafure ground there are two circular walks, the diameter of the one is 80 yards; and the other contains 10 times the area; Req. its diameter? Anf. 252.98 yards.

9. Two men fet off from the fame place; the one travels eaft 20 miles per day, and the other fouth 26; How far are they diftant on the evening of the 7th day? Anf. 229.61 miles.

10. A rope 400 yards long fufpended from the top of a wall 900 feet high, reaches the oppofite bank of a river running by the foot of the wall; Req. the breadth of the river? - - - - - - - Anf. 793.7 feet.

11. The diameter of a malt-kiln is 13 feet, and is too little by ⅘; Req. the diameter of one that will anfwer the purpofe? - - - - - - - - - Anf. 17.4 feet.

12. A furveyor meafuring a marfh found that it lay exactly in the fhape of a right angled triangle; that the bafe meafured 905 links, and the perpendicular 840; but the hypothenufe being inacceffible, could not be meafured with the chain, refolves to find it by the fquare root; Req. its length? - - - - - Anf. 1234.75 links.

13. A fun-dial is placed in a ftraight line betwixt an obelifk and a fteeple, and is juft 148 feet from the top of each; the fteeple is 124 feet high, and the obelifk 84: they ftand on the oppofite banks of a fifh-pond; Req. its breadth? - - - - - - - - Anf. 202.64 feet.

14. Suppofe a fpectator on the top of an eminence 12 feet high (including the height of the eye), and the fen-fible horizon free of all obftruction to the fight; It is required to find how far he will fee by looking around him on the furface of the globe?

Solution.—The diameter of the earth is found by experiments to be 7970 miles; confequently, its femidiameter is 21040600 feet.

Now, to the ½ diameter of the earth	21040600
Add the height of the fpectator - -	12
Makes - - - - - - - -	21040612
The fq. of which is	442707353334544
Subtract fq. ½ diam.	442706848360000
Leaves - - - - - -	504974544 √ 22471 feet.

Anf.=4 miles, 2 fur. 1 pole.

15. What is the difference betwixt 3 feet fquare, and 3 fquare feet? - - - $3 \times 3 = 9 - 3 = 6$ feet, Anf.

PROB. II.—*To extract the* CUBE ROOT.

RULE I.—Divide the given numbers into periods of three figures each, beginning at the place of units.

II.—Find the greateft cube in the left hand period; place its root in the quotient; fubtract the cube itfelf from the faid period, and to the remainder annex the following period, which call the *refolvend.*

III.—Multiply the fquare of that part of the root found by 300 for a trial divifor; by which divide the *refolvend,* and put the quotient figure for the fecond place in the root.

IV.—Multiply the former part of the root by the laft figure placed in it, and this product again by 30, which place under the trial divifor; and, laftly, under the fame write the fquare of the figure laft placed in the root, which will complete the divifor.

V.—Multiply the fum of thefe three by the figure laft placed in the root, and fubtract the product from the *refolvend;* to the remainder annex the next period for a new *refolvend,* with which proceed as before.

Note. When there are decimals in the given number, each period muft confift of three decimal places; and if the given decimal does not contain fo many places, the deficiency muft be fupplied by annexing cyphers.

EXAMPLES.

1. Req. the cube root of 12812904?

$$12812904(234 \text{ Anf.}$$
$$8$$
$$1200)4812$$
$$180$$
$$\underline{9}$$
$$1389\ 4167$$
$$158700)645904$$
$$2760$$
$$\underline{16}$$
$$161376)645904$$

Proof. The cube of the root with the remainder added (if any), will exactly equal the given number.

2. Req. the cube root of 122615327232? Anf. 4968
3. ——————— 1848537525?
4. ——————— 84.75?
5. ——————— .97345?
6. ——————— 1.9995?

PRACTICAL QUESTIONS.

1. An earthen mound is 340 feet long, 280 broad, and 240 deep; Req. the length of the fide of a cube equal to it in magnitude?　- - - Anf. 283.69 feet.

2. A diftiller has a granary whofe length is 17 feet, breadth 10, and depth 8, which holds 170 bolls; Req. the dimenfions of a fimilar one that will hold 1360 bolls?
　　Anf. Length 34, breadth 20, and depth 16 feet.

3. Req. the weight of a bullet of brafs whofe diameter is 4 inches, when one of 8 inches diameter of the fame metal weighs 72 lib.?

Solution.—*Like folids are in proportion as the cubes of their diameters.* Therefore, as 512 : 64 : : 72 lib. : 9 lib. the anfwer.

4. If a globe whofe diameter is 8 inches weigh 20 lib. Req. the diameter of another globe of the fame metal whofe weight is 300 lib.　- - - Anf. 19.7 inches.

5. If the folid content of a globe be 175616, What is the fide of a cube of equal folidity?　- - Anf. 56

6. Req. the side of a cubical granary that holds 500 bolls of wheat? - - - - Anf. 13 feet, 7 inches.

7. There is a ftone of a cubical form that contains 35937 folid feet; Req. the fuperficial content of one of its fides? - - - - - - - - Anf. 1089 fq. feet.

8. Req. the length of the fide of a cubical cheft that will hold 8500 oranges, each $2\frac{1}{2}$ inches diameter?

Anf. 51.02 inches.

9. What is the difference betwixt half a foot folid, and half a folid foot?

$$12 \times 12 \times 12 = \frac{1728}{2} = 864 \text{ half a folid foot.}$$
$$6 \times 6 \times 6 \quad - \quad = 216 \text{ half a foot folid.}$$

Anf. $\overline{648}$ cubic inches.

DUODECIMALS.

RULE I.—Under the multiplicand write the corref-ponding denominations of the multiplier.

II.—Multiply each term in the multiplicand, beginning at the loweft, by the feet in the multiplier; write each refult under its refpective term, and carry at 12.

III.—In the fame manner multiply by the inches or primes in the multiplier, and write the refult of each term one place more to the right.

IV.—Proceed in the fame manner with the feconds, thirds, &c. always fetting the refults one place more to the right; and, in adding the feveral products, carry at 12, and the fum will be the anfwer.

EXAMPLES,

1. Mul. 9 feet 4 inches, by 4 feet 4 inches.

	feet.	'	"	
9	4			
4	4			
37	4			
3	1	4		
Anf. 40	5	4		

(2.) Mul. 22 feet 3' 8"
By 8 feet 5' 2"

178	5	4		
9	3	6	4	
3	8	7	4
Anf. 188	0	6	11	4

3. Mul. 9 feet 7 inch. by 3 feet 6 inch. Anf. 33 f. 6' 6".
4. —— 12 feet 6 inch. by 4 feet 6 inch. Anf. 56 f. 3' 0".
5. —— 28 feet 3 inch. by 3 feet 6 inch. Anf.
6. —— 125 feet 5 inch. by 3 feet 3 inch. Anf.

Note.—When the number of feet is large, multiply all the denominations in the multiplicand by the feet in the multiplier; and take aliquot parts for the inches, seconds, &c.

EXAMPLES.

1. Mult 134 2 9
   By   11 6   feet.   '   "
        ————————
       1476 6 3   = 134 2 9 × 11
         67 1 4 6 = ½ of do.
        ————————
Anf. 1543 7 7 6 = total product.

TABLE OF ALIQUOT PARTS.

1 Inch == $\frac{1}{12}$ of a foot.	7 Inches == $\frac{1}{2}$ & $\frac{1}{12}$ of a foot.
2 Do == $\frac{1}{6}$ of do.	8 Do. == $\frac{1}{2}$ & $\frac{1}{6}$ of do.
3 Do. == $\frac{1}{4}$ of do.	9 Do. == $\frac{1}{2}$ & $\frac{1}{4}$ of do.
4 Do. == $\frac{1}{3}$ of do.	10 Do. == $\frac{1}{2}$ & $\frac{1}{3}$ of do.
5 Do. == $\frac{1}{3}$ & $\frac{1}{12}$ of do.	11 Do. == $\frac{1}{2}$, $\frac{1}{3}$, & $\frac{1}{12}$ of do.
6 Do. == $\frac{1}{2}$ of do.	

2. Mul. 774 feet 4 inch. and 10 parts, by 9 feet 9 inch. Anf. 7550 f. 5' 1" 6'''.
3. —— 404 f. 5 in. and 9 parts, by 12 f. 10 in. Anf.
4. —— 554 f. 6 in. and 11 parts, by 42 f. 8 in. Anf.

APPLICATION TO BUSINESS.

1. There is a board 14 feet 3 inches in length, 2 feet 3 inch. and 4 sec. in breadth; How many square feet does it contain? - - - - - - Anf. 32 f. 5' 6".

2. How many solid feet are contained in a log of mahogany whose length is 21 feet 4 inches, breadth 3 feet 5 inch., and thickness 2 feet 7 inch.? Anf. 188 f. 3" 6" 8'''.

3. How many square feet are contained in a floor that measures 33 feet 8 inch. by 22 feet 9 inch.; and what

will the carpenter's account come to, at L 3 15 per square of 100 feet? - - - Anf. 765 f. 11'.—L 28 14 7½.

4. Suppofe a bale of goods to be 4 feet 9 inch. long, 3 feet 9 inch. broad, and 4 feet 6 inch. thick; Req. its tonnage and freight, at L 3 per ton?

Anf. 2 t. o f. o' 6" tonnage.—L 6 o 2½ freight.

5. A houfe of 3 ftories contains 7 windows in each ftory. The height of the windows in the firft and fecond ftories is 6 feet 10 inches; thofe in the third, 5 feet 4 inches; the breadth throughout is 3 feet 10 inches and 6 parts; What will the expence of glazing come to, at 1s. 2d. per foot. - - - - - - - Anf. L 30 1 3.

6. There is a window that contains 32 panes of glafs, each meafuring 14 inch. 9 parts, by 10 inch. 9 parts; How many fquare feet of glazing does it contain, and what will be the expence, at 1s. 3d. per fquare foot?

Area 35 f. 2' 10".—Expence L 2 4 0¼ Anf.

7. If a wall be 45 feet 6 inches long, 12 feet 4 inches high, and 2 feet 3 inches thick; How many folid feet does it contain? - - - - - Anf. 1262 f. 7' 6".

8. Req. the content and value of a flab of marble whofe length is 6 feet 3 inches, and breadth 3 feet 9 inches, at 7s. 6d. per fquare foot?

Content 23 f. 9'.—Value L 8 18 1½ Anf.

PROMISCUOUS QUESTIONS.

1. A merchant has in cafh L 114; in accounts L 419; in bills L 715; a houfe worth L 841; a fhip valued at L 600; a fmall eftate to the value of L 940; goods on hand to the amount of L 777; What does the whole amount to? - - - - - - - - - Anf. L 4406.

2. An old man's age being afked, anfwered, I have 18 children, the eldeft of which was born when I was 27 years old, and on an average there were 2 years betwixt the births of each of them, and now the youngeft is 32 years; Req. the old man's age? Anf. 93 years.

3. What number multiplied by 7 and divided by 9, will quote 144? - - - - - - - - Anf. 185 1/7.

4. If the inhabitants of a village consume 4 bolls of wheat in a day, What quantity at that rate will serve them a year? - - - - - - - - Anf. 1460 bolls.

5. How many barleycorns, each placed end to end, will reach round the terreſtrial globe, it being divided into 360 degrees, each degree containing $69\frac{1}{2}$ miles?

Anf. 4755801600 barleycorns.

6. If 1 copper penny-piece weigh 12 drams Avoird. What will be the weight of L 5 ſterl. of the ſame metal?

Anf. 56 lib. 4 oz.

7. How many yards of cloth will be ſufficient to clothe 3420 men, when each takes 5 yds. 3 qrs. 3 nails?

Anf. 20306 yds. 1 qr.

8. How often will a wheel of 23 feet 4 inches circumference turn round its axis in running the diſtance of 144 miles, 3 furlings, and 14 poles? Anf. $32679\frac{9}{10}$ times.

9. Bought two pieces of cloth, each containing 48 yards, which coſt in all L 25 12. The firſt piece coſt 4s. per yard; Req. the price per yard of the ſecond?

Anf. 6s. 8d.

10. If a labourer receives 1s. 2d. for every working day for the firſt 10 months, and only 10d. per day for the remaining 2 months; What does his wages amount to per year? - - - - - - - Anf. L 17 7 10.

11. A builder has 22 maſons at 1s. 8d. per day; 12 barrowmen at 1s. 2d.; 8 miners at 1s. 10d.; 9 carters at 1s. 1d.; and 2 wrights at 1s. 7d. per day; What ſum does he pay them weekly? - - - Anf. L 23 9 6.

12. A ſnail in getting up a tall tree was obſerved to climb 16 inches per day, but every night came down 7; In how many days by this method would he reach to the height of 80 feet 1 inch? - - - - Anf. 106 days.

13. If 44 yards of broad cloth are worth 176 yards of linen, and 12 yards of linen worth L 2; How many yards of broad cloth, at the ſame rate, are worth 840 yards of linen, at 3s. $9\frac{1}{4}$d. per yard? Anf. 238 yds. 3 qrs. 2 n.

14. If the high-way betwixt Cupar and Kinghorn be 22 miles long, and 30 feet broad; How many Scots acres

does it contain, and what will its value amount to, at L 27 10 per acre? Anf. 67.2 ac.—Val. L 1848 12 2½.

15. 2700 foldiers are to be ranked, fo that the front is to confift of 105 men ; How many men muft there be in the file? - - - - - - - - Anf. 25 men.

16. What number is that to which if you add its double, treble, and quadruple, the fum will be equal to ⅓ part of its product? - - - - - - - Anf. 30.

17. If a merchant gains 30 per cent. by a falfe balance whofe beam is 8 inches long, by buying on the fhorteft end, and felling on the longeft; Req. the refpective lengths of the arms of the beam? Anf. 4.264 and 3.736 in.

18. What is the fum of ⅘ of a guinea, ⅚ of a pound, ¼ of a moidore, and ⅘ of a crown? Anf. L 2 18 1¾ 11⁄15.

19. Suppofe a merchant to buy eggs at 5 for 2d. and fell them at 5d. per dozen; What would he gain or lofe on 6000? - - - - - - - - Anf. 8s. 4d. gained.

20. If 8 men, or 12 boys, can finifh a piece of work in 16 days; In what time will 5 men and 3 boys finifh the fame?

   a.   c.   days.   days.
1ft. 5 : 8 :: 16 : 25.6, time 5 men will take.
2d. 3 : 12 :: 16 : 64. time 3 boys will take.
      ———   days. days.
   Then, as 89.6 : 25.6 :: 64 : 18.28 Anf.
    a. c. days. days.
    Or, 7 : 8 :: 16 : 18.28 Anf.

21. It is computed that 60 workmen will finifh a piece of work in 40 days; but the proprietor, after 8 days work, will have the remainder finifhed in 12 ; How many additional hands muft be employed?
         Anf. 100 workmen.

22. Being ftraitened for money, I difcounted my own bill of L 200 at the bank, dated January 1ft, payable in 3 months, deducting intereft at 5 per cent. Paper and other expences came to 4s. I was obliged to repeat the tranfaction 4 times in the year, and paid the laft bill

K

when it became due; At what rate of intereſt had I my money? - - - - - - Anſ. L 5 10 0½ per cent.

23. If 8 cannons in 4 days ſpend 48 barrels of powder; How many barrels will 32 cannons ſpend in 12 days? - - - - - - - - - Anſ. 576 barrels.

24. A hare ſtarting 45 yards from a greyhound is not perceived by him till ſhe has been up 40 ſeconds : She ſcuds away at the rate of 15 miles per hour, and the dog makes after her at the rate of 18 ; How long will the chaſe hold, and how far will the dog run before he catches her ? Anſ. $\left\{ \begin{array}{l} 3.844 \text{ min. time} \\ 2029.984 \text{ yds. length} \end{array} \right\}$ of the chaſe.

25. Bought 36 pipes of wine at L 1444 14; At what muſt I ſell it per pipe ſo as to ſave one for my own uſe, and gain L 25 on the whole? - - Anſ. L 42.

26. If 1½ ounce of ſnuff coſt 6⅔d. ; What will 5½ cwt. coſt? - - - - - - - - - Anſ. L 182 10 4¼ 7/9.

27. If ⅘ of a yard coſt 7/9 of a guinea; How many yards at that rate may I have for L 24 9? Anſ. 23 2 3 3/2 4 5 yds.

28. Suppoſe a clergyman to receive of ſtipend from G L 22 10, and 15 bolls, 3 firlots of barley ; from K L 18 15, and 19 bolls, 1 firlot of meal; from L L 27 13 4, and 12 bolls, 2 firlots of meal ; from Q L 9 14, and 6 bolls, 1 firlot of meal; and from Q L 11 4, and 9 bolls, 1 firlot of barley : Req. the amount of his living, when the barley is converted at 15s. and the meal at 10s. ?
Anſ. L 127 11 4.

29. A greyhound ſpying a hare at the diſtance of 60 of his own leaps, purſues her, making 3 leaps for every 4 of hers, and paſſing over as much ground at 2 leaps as ſhe did at 3 ; How many leaps did each make during the chaſe? Anſ. $\left\{ \begin{array}{l} \text{The hare made } 720 \\ \text{And the dog } \quad 540 \end{array} \right\}$ leaps.

30. A certain ſociety collect among themſelves the ſum of L 45 1 4. Every one contributed as many farthings as there were members in the whole ſociety ; Req. the number of members? - - - - - Anſ. 208.

31. If 4½ yards of cloth, 7 qrs. wide, be ſufficient for a

suit of clothes; How many yards, 4 qrs. wide, will it take to fit the same person? Anf. 7 yds. 3 qrs. 2 nails.

32. Req. the least number possible that can be divided by 3, 5, 7, 9, and 11, without leaving a remainder?

Anf. 3465.

33. If 3 women can each spin a certain quantity of yarn (suppose 4 spindles), as follows, viz. *Eliza* once in 3 weeks; *Ella* thrice in 8 weeks; and *Phillis* 5 times in 12 weeks; In what time will they jointly spin 100 spindles at that rate? Anf. 22 weeks, 1 day, 4 hours.

34. Five persons hire a coach for 3 guineas to go 50 miles: Now when they had gone 12 miles, they overtook a traveller who agreed with them for a seat, on condition of paying a proportional part of the hire; What sum must he pay? - - - - - Anf. 8s. 3¾d.

35. If a schoolmaster's salary be L 22 per annum; What has he per day? - - - - Anf. 1s. 2¼d. 6¾/₇₃.

36. Whether will one cubic box whose side is 16 inches, or 48 other cubic boxes each of whose sides is 4 inches, contain the greatest quantity?

Anf. { The large one contains 1624 cubic inches more than the 48 small ones.

37. How many gooseberry bushes, each 6 feet distant, may be planted on a Scots acre of land; how many pints of berries will they produce annually, allowing 3 pints to each bush; and what will be the nett amount of the produce when the berries are sold at 3d. per pint?

Anf. 1537 bushes, 4611 pints, at 3d.——L 57 12 9.

38. Suppose the earth's mean distance from the sun to be 95 millions of miles, and travels round him in 365 days, 5 hours, and 49 minutes; At what rate does it travel per hour, and per minute?

Anf. 68094 m. per hour. 1134.9 m. per minute.

39. It is found by an exact experiment, that a column of air whose base is a square inch, extended to the top of the atmosphere, weighs 15 lib. Now, as the atmosphere presses equally in all directions, Req. the weight

of air upon a middle fized man whofe furface may be reckoned 16 fquare feet? Anf. 308 cwt. 2 qrs. 8 lib.

40. If in a field of wheat 1 fquare ell contains 324 ears, and each ear on an average 20 grains; What quantity will a Scots acre produce when 3,000,000 grains middling good wheat make a boll?

Anf. 12 bolls, 1 firl. 3 pecks.

F I N I S.

E R R A T A.

Page   5, Ex. 10, for 469 read 496 Anf.
—— 9, —— 12, for 17 perfons read 7
—— 32, Rule 3, for compliment, read complement,
—— 68, Ex. 4, for 75 cwt. read 25
—— 72, Cafe 3, Ex. 1, for 190 read 100
—— 75, Ex. 3, in fome of the copies, for 231 read 233 Anf.
—— 81, Ex. 1, for L 52 read L 132
—— 82, Line 1, for May 1, read May 31,
—— —— —— 11, for 18th read 19th
—— 91, Ex. 10, for 3s. 6d. read 3s. 6¼d.
—— 94, —— 10, for 9 fols read 10
—— 104, —— 1, laft divifor, for 161376 read 161476